



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

BIRTH FRACTURES AND
EPIPHYSEAL DISLOCATIONS

EDWARD D. TRUESDELL

LANE MEDICAL LIBRARY STANFORD STOR
P325 .T86 1917
Birth fractures and epiphyseal dislocati



24503360200

LANE

MEDICAL



LIBRARY

LEVI COOPER LANE FUND

100



**BIRTH FRACTURES AND
EPIPHYSEAL DISLOCATIONS**

BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

By

EDWARD D. TRUESDELL, M. D.

ASSISTANT ATTENDING SURGEON AND ROENTGENOLOGIST THE LYING-IN
HOSPITAL, ASSOCIATE SURGEON THE ST. MARY'S FREE
HOSPITAL FOR CHILDREN, NEW YORK



PAUL B. HOEBER
NEW YORK

COPYRIGHT, 1917
BY PAUL B. HOEBER

Published, November, 1917

Y9A9B1: 3B1A1

PRINTED IN THE UNITED STATES OF AMERICA

FOREWORD

A review of the standard American text-books on Obstetrics will disclose the meagerness of the information available upon an important obstetrical complication, fractures in the new-born. Either these injuries are of such comparative infrequency as to merit no more than the brief comment with which they are ordinarily dismissed, or they have not received the attention they reasonably deserve. Furthermore such information as is available is often misleading in creating the impression that dislocation of the epiphyses is more common than fracture of the shafts of the long bones, and that fracture, when it does occur, is usually of the green-stick variety. These presumptions are not borne out by the facts now presented. No green-stick fracture, in the sense of an injury to a long bone in which the bone is partly broken through and partly bent, has been discovered among the several hundred infants referred for roentgen examination because of possible birth injury. All fractures have been found not only to be complete, when studied in the roentgenogram, but have been associated with considerable displacement of the fragments, indicating a more or less extensive laceration of the periosteum. While the possibility of dislocation of the cartilaginous epiphyses has been held constantly in mind, evidence of the presence of this injury has been rarely obtained, even when the method of proving its existence has been understood and applied. That more is not definitely known concerning birth fractures and dislocations is probably due to the frequent inadequacy of roentgen facilities in the care of these injuries. Mention might be made in passing of the rather general opinion that some obscure risk of injury to the pregnant woman or the new-born child is entailed in exposing them to the influence of the roentgen ray. During several years' experience with these patients in the roentgen laboratory there has not been a single incident to lend any support whatsoever to this belief, and roentgen examinations have been freely resorted to for purposes of diagnosis and investigation very much to the benefit of both classes of patients. The difficulty of obtaining satisfactory pictures of infants has, in fact, necessitated more numerous exposures

in many instances than would corresponding conditions in adults, and entirely without detrimental consequences.

The material composing this book has been derived almost exclusively from the various divisions of The Lying-In Hospital. During the past six years it has been the writer's privilege to treat, with unlimited roentgen resources, practically all of the fractures and bony birth injuries that have occurred at the hospital. As a natural consequence of the difficulties encountered in the treatment of these diminutive patients, whose displacements and deformities so often frustrated the most persistent attempts at their correction, much attention has been devoted to the subsequent course of these injuries. For this reason much space is devoted to serial roentgenograms of individual cases often extending over months or even years. The interest in these observations at long intervals has fully compensated for the difficulties and discouragements met with in obtaining them. Several of the most interesting cases unfortunately could not be found after their departure from the hospital. Certainly any enthusiastic coöperation on the part of the parents has been rare. Ignorance, suspicion, sickness, home conditions, the weather, the tender age of the patients and a shifting population have all combined to cause breaks in some series of pictures and to effect the elimination of others altogether.

A few words of explanation may anticipate undue criticism. The number of birth fractures might seem large were it not appreciated that these were incidental to more than thirty-three thousand deliveries. Some of the roentgenograms reproduced are such as might be excusably omitted by the author of a similar book upon fractures in adults, their sensational appearance certainly not reflecting the effort expended upon their treatment. The examples of fracture of the humerus have been intentionally chosen from the cases presenting the greatest deformity. Twelve of the thirteen cases of birth fracture of the femur are represented, regardless of the unfavorable appearance of some, in the belief that they will suffer most in comparison with these injuries treated by others which have escaped thorough roentgen examination. Several of these patients were attended in their homes, which increased the difficulty in maintaining the dressings in the condition desired, and at the same time limited the opportunities for roentgen examination. Others were more or less tardy in making their initial appearance. The early part of the investigation of birth fractures sought to determine the efficiency of the methods of treatment then prevalent, with not a little prejudice in favor

of the opinion commonly held that these injuries took good care of themselves however treated. With increasing experience it became evident that these fractures required more particular attention, and various methods of treatment were experimented with in the endeavor to obtain more satisfactory reduction and immobilization. These were too numerous to present individually, and too unsatisfactory for continued employment. The need of efficient treatment is more apparent than is the manner in which this may be obtained.

It is hoped that this book may offer an introduction to a group of interesting fractures, hitherto relatively unfamiliar, and that it may claim a place for itself, however small, if it do no more than direct attention to something of the appearance, tendencies, and course of birth fractures.

The work done upon the birth dislocations of the cartilaginous epiphyses may prove to be somewhat new. The study of this lesion has been limited by the infrequency of its occurrence. Since the existence of this injury can be proven by its distinctive appearance in the roentgenogram, a definite diagnosis can be made when desired and the number of merely suspected birth dislocations largely reduced.

The present opportunity is welcomed to express my sincere gratitude to Dr. James W. Markoe and to Dr. Asa B. Davis, whose unfailing generosity and constant interest have made possible this book. Nor have the other attending surgeons of The Lying-In Hospital been less liberal in contributing such cases as were at their disposal while on service from time to time.

For timely aid in the matter of publication and for many courtesies shown, I am indebted to Mr. Paul B. Hoeber.

EDWARD D. TRUESDELL.

260 West 72nd Street, New York.

November, 1917

CONTENTS

PART ONE

FRACTURES

	PAGE
FRACTURES OF THE SKULL	15
FRACTURES OF THE HUMERUS	31
FRACTURES OF THE CLAVICLE	37
FRACTURES OF THE FEMUR	60

PART TWO

DISLOCATIONS OF THE CARTILAGINOUS EPIPHYSES

DISLOCATION OF THE INFERIOR FEMORAL EPIPHYSIS	111
DISLOCATIONS OF THE INFERIOR HUMERAL EPIPHYSIS	112
DISLOCATIONS OF THE SUPERIOR HUMERAL EPIPHYSIS	115

LIST OF ILLUSTRATIONS

FIGURE		PAGE
1.	Birth fracture of occipital bone	19
2-9.	Birth fractures of parietal bone	20-24
10-12.	Birth depressions of vault of skull	25-26
13.	Traumatic periostitis of parietal bone	27
14-17.	Molding of the head in the new-born	27-29
18.	Kosmak elevator	29
19.	Birth fracture-dislocation of the cervical vertebræ	30
20-21.	Birth fractures of the clavicle	39
22-37.	Serial roentgenograms of birth fractures of the humerus with outward angular deformity	40-48
38-41.	Birth fracture of the humerus with lateral displacement of the lower fragment	49
42-45.	Birth fracture of the humerus with Erb's birth paralysis	50-51
46-47.	Birth fractures of both clavicles and both humeri	52
48-51.	Deformities in the anteroposterior plane following birth fracture of humerus	53-54
52-55.	Late correction of deformity following birth fracture of humerus	55-56
56.	Diagram showing elimination of deformity after birth fracture of humerus	57
57.	Dissection of musculospiral nerve following birth fracture of humerus	58
58-59.	Treatment of birth fracture of humerus	59
60-76.	Late results of birth fracture of femur following inadequate early treatment	66-79
77-82.	Birth fracture of femur treated by the Van Arsdale splint	80-84
83-84.	Birth fracture of femur in the Wyeth dressing	85-86
85-86.	Birth fracture of the femur following treatment in the box-splint	87
87-96.	Birth fractures of the femur treated by the Van Arsdale splint	88-95
97-109.	Birth fractures of the femur treated in the box-splint	96-100
110-111.	Deformity following birth fracture of the femur difficult to reduce	101
112-113.	Birth fractures of femur showing excessive displacement of fragments	102-103
114-115.	Pathological specimens of birth fracture of the femur	104
116.	The Van Arsdale splint	105
117-119.	The box-splint	106-107
120-126.	Birth dislocation of the lower femoral epiphysis	117-121
127-129.	Diagram birth dislocation of the lower humeral epiphysis	122
130-131.	Pathological specimens of birth dislocation of the lower humeral epiphysis	123
132-148.	Birth dislocations of the lower humeral epiphysis	124-132
149-151.	Birth dislocations of the upper humeral epiphysis	133-135

FRACTURES

FRACTURES OF THE SKULL

Fracture of the vault of the skull in the new-born has been the least frequent of the birth injuries verified in the roentgenogram at The Lying-In Hospital. Fractures of the humerus, clavicle and femur are all rated higher in the order of frequency. The pliability of the cranial bones, together with their facility of adjustment afforded by the wide and open sutures, seems to render the vault of the skull relatively exempt from fracture. It will be quite generally conceded that the majority of birth injuries to the head are unaccompanied by fracture of the bones composing the cranial cavity. Symptoms of brain injury of the most serious kind are commonly observed with perfect integrity of the over-lying bones, and frequently even without their excessive displacement. The deepest asphyxia, stupor, circulatory and respiratory irregularities may all be present in the new-born following violent and protracted labor, with or without instrumentation, and a roentgen examination of the head reveal the absence of bone injury. On the other hand a fracture of the vault of the skull may be present without ascertainable evidence of injury to the brain beneath.

Four cases of fissure-fracture of the cranial bones have been observed in the new-born child, one with and three without displacement of the fragments. *Case 1* without displacement presented a transverse fracture of the occipital bone, the line of fracture evidently following the furrow containing the lateral sinus. This fracture had been produced by compression of the infant's head in the pelvic inlet during difficult breech delivery. *Case 2* showed a transverse fracture of the right half of the frontal bone, the line of fracture passing horizontally from the frontal to the coronal suture, an injury produced during forceps delivery. Attention had been attracted to the condition in both cases by an over-lying sub-periosteal hematoma; there was no suggestion of intra-cranial injury in either case and in both the recovery and subsequent course were uneventful.

Case 3 of fissure-fracture of the vault of the skull in the new-born, without displacement, occurred in an infant one week old. This infant was rolled from the foot of a bed and fell to the tiled floor some three feet below.

16 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

The impact of the fall was received upon the vertex of the skull. The infant was stunned momentarily, but soon cried vigorously and was then soothed by nursing. A hematoma developed rapidly over the right parietal bone, while beneath this the tip of the examining finger could trace horizontally across the bone a definite fissure, extending from the coronal to the lambdoidal suture. The roentgenograms confirmed the diagnosis of fracture of the parietal bone. (Fig. 5.) There were no symptoms of brain injury, other than the brief period of concussion, the recovery was rapid and uneventful and the infant, watched for more than one year, was normal in every way when last examined. *Case 4* of fissure-fracture of the vault of the skull in the newborn was accompanied by depression of the fragment. This occurred in a case of face presentation where the uterine contractions were intense, the infant of large size and the labor protracted. The fracture was spontaneous in origin. Upon the delivery of the infant a large depression of the right parietal bone was immediately evident. This had distinctly the appearance of an indentation of the skull, and was thought to be such until the roentgenogram proved the injury to be a fissure-fracture of the parietal bone with depression of the fragment. (Fig. 3.) The infant was otherwise entirely normal, and there were no symptoms suggestive of intracranial injury. An extremely large hematoma rapidly developed over the site of the depression, which delayed the proposed operation for the elevation of the depressed fragment. The hematoma was aspirated but promptly refilled. During the first few days there was such evident improvement in the condition of the depressed fragment that operative interference was finally abandoned. The infant left the Hospital in excellent condition, was found still to be so eight months later, when the evidences of the birth fracture of the skull had been almost entirely obliterated.

A characteristic sign of fracture of the vault of the infant skull as exemplified by the four cases just described is the accompanying subperiosteal hematoma. This was noted in all four cases, being large in the two cases of fracture of the parietal bone, small in the fractures of the frontal and occipital bones. This hematoma is formed by the accumulation of blood beneath the pericranium, stripped up for a variable distance from the surface of the affected bone, and is readily distinguishable from the more common cephalhematoma. It is ordinarily present at birth, when it may be discovered if looked for, perhaps increasing in size during the first twenty-four hours, while a cephalhematoma does not make its appearance until several days later; it is not likely to cover the entire area of the fissured bone, and

is irregular in outline, while the cephalhematoma raises the pericranium from the bone affected from margin to margin, the outline of the tumor representing the outline of the particular bone involved; the sub-pericranial hematoma feels soft and watery, the cephalhematoma being decidedly tense and elastic upon palpation.

Since the introduction of the roentgen laboratory six years ago at The Lying-In Hospital no opportunity has been afforded to roentgenograph a case of so-called birth indentation of the skull. Luckett¹ has shown that a true indentation of the skull may occur. An infant five and one-half months old fell from a couch to the floor, a distance of less than two feet, receiving what was apparently a depressed fracture of the right parietal bone. Upon exposure at operation it was found that this depression was a true indentation, and not a depressed fracture, the margins of which were formed by curved and unbroken bone. To accomplish elevation the center of the indentation was trephined, which permitted examination of the inner table of the bone through the opening. There was no evidence of fracture of the inner table.

Kosmak² has reported four cases of depressed fracture of the skull occurring as birth injuries. Three involved the frontal bone, forceps having been applied in all, and one the parietal, a spontaneous delivery, evidently a case comparable with that shown in Fig. 3. The depression was elevated in all cases, with complete relief of the symptoms of pressure upon the brain that had been present in the cases affecting the frontal bone.

In a case of Dr. A. B. Davis, shown in Fig. 11, 12, a depression of the right frontal bone resulted from pressure of the infant's brow upon the promontory of the sacrum during forceps delivery. There were no symptoms of brain injury in this case, while the depression was elevated by passing a periosteal elevator beneath the bone through an incision made along its coronal margin.

It is as unfortunate that these cases occurred before the establishment of the roentgen laboratory at The Lying-In Hospital as it is curious that no opportunity has been afforded since to obtain roentgenograms of apparent indentations of the skull in the new-born, for while indentation is entirely possible it is quite probable that the roentgen examination of the head when this injury has been sustained might show a fracture of the bone involved with depression of a detached fragment. Both the appearance of this injury and the sensation obtained upon palpation of the affected area convey the impression

18 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

of indentation, and may be misleading in the absence of the roentgen examination.

Depressions of the vault of the skull should be immediately elevated, whether indications of pressure upon the brain are present or not. Where such symptoms are noted the result of elevation may be most satisfactory; their absence, however, offers no guarantee against the development of unfortunate consequences later in life. Furrows and irregularities of the skull, sometimes situated beneath scars outlining portions of the forceps blades, have been observed in perfectly healthy adults, and in some instances spontaneous elevation of the depressed fragment, more or less complete, has been witnessed, but as the elevation of the depression can be so readily accomplished, particularly if undertaken promptly, there is usually no reason to omit this treatment.

Kerr³ has advocated and practiced elevation by firm compression of the head between the hands in an anteroposterior direction. Tweedy⁴ has suggested the utility of introducing the point of a volsellum blade through the bone at the depth of the depression, thus effecting elevation. Kosmak has devised a very practical instrument (Fig. 18) especially intended for this procedure, which might well be included in the routine obstetrical equipment.

REFERENCES

- ¹ LUCKETT. *Ann. Surg.*, April, 1910.
- ² KOSMAK. *Bull. Lying-In Hosp.*, Vol. IX, No. 1.
- ³ KERR. "Operative Midwifery," 3rd Ed., Chapter XXXVII.
Brit. Med. Jour., Jan., 1901.
- ⁴ TWEEDY. "Practical Obstetrics," 2nd Ed., 1910, p. 332.
- ⁵ *Commandeur l'Obstétrique*, July, 1910, p. 609.



FIG. 1.—*Case 1.* Transverse fracture of the occipital bone produced by compression of the head in the pelvic brim during difficult breech extraction. Pressure had been applied above while traction was made from below. The line of fracture evidently followed the furrow in the bone containing the lateral sinus. Union has taken place between the condyloid and occipital portions of the bone, where a point of motion is usually noted. (See Fig. 19.)

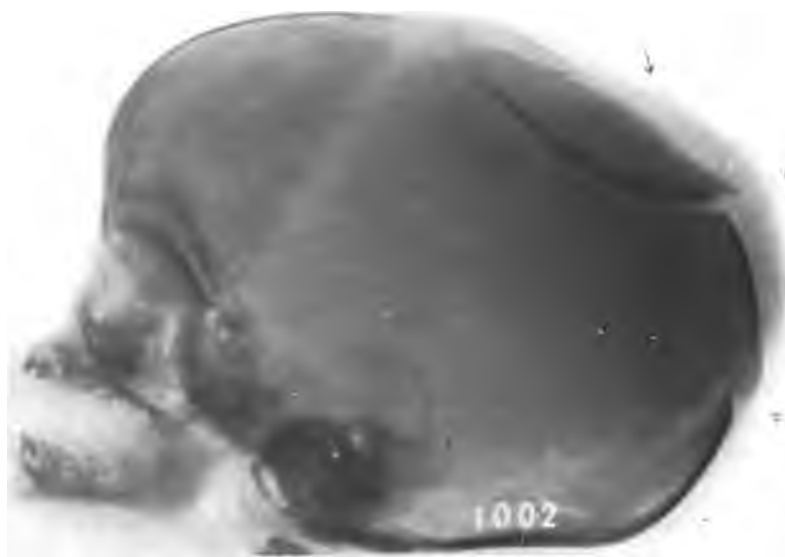


FIG. 2.—*Case 2.* Fissure-fracture of the parietal bone, produced by intense uterine contractions accompanying the expulsion of a large child presenting by the face. A large hematoma of the scalp surmounted the fracture, there was no evidence of intracranial injury.

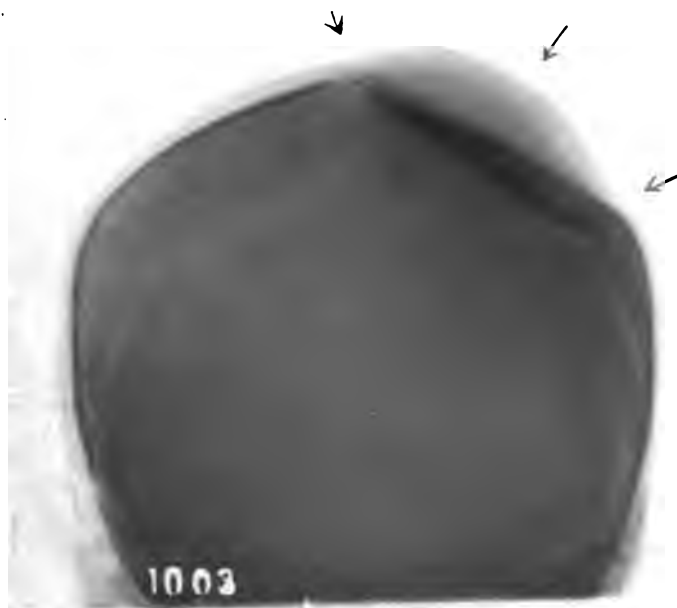


FIG. 3.—*Case 2.* The anteroposterior view showed depression of the fractured portion of the parietal bone, with the overlying hematoma. Because of the hematoma no immediate attempt was made to elevate the fragment, which had spontaneously returned to approximately its normal position by the end of the first week.



FIG. 4.—*Case 2.* At the eleventh month the infant was found to be normal in every respect. There was slight asymmetry of the skull. The roentgenogram showed slight flattening of the calvarium in the region of the fracture, with some thickening of the parietal bone below



FIG. 5.—*Case 3.* Fissure-fracture of the vault of the infant skull, the line of fracture passing horizontally across the parietal bone from suture to suture without displacement of the fragments, and without symptoms of intracranial injury.

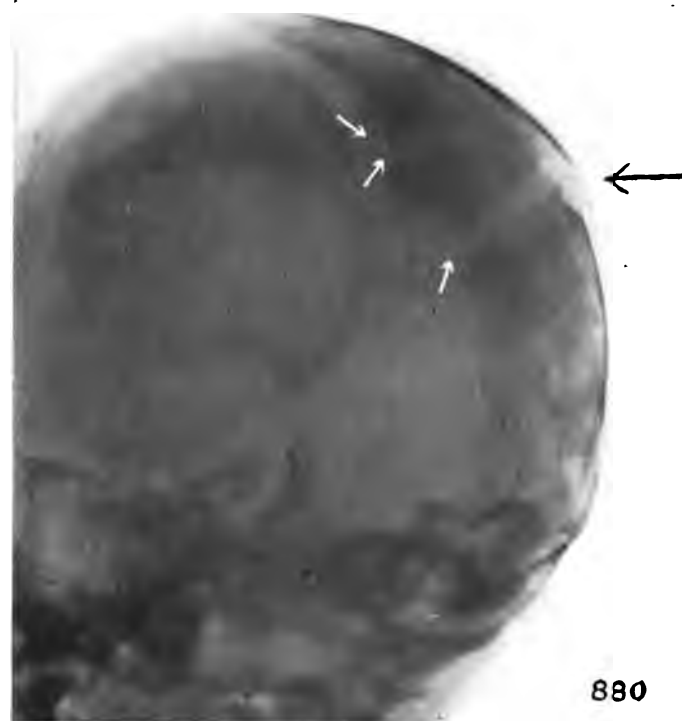


FIG. 6.—*Case 3.* An oblique view on the eighth day showed the bursting nature of the fracture. The line of fracture could be traced both forwards and backwards.



FIG. 7.—Case 3. The anteroposterior view showed the line of fracture passing through the parietal prominence, with the separation of the fragments and the prolongation of the fracture backward.



FIG. 8.—Case 3. At the sixth week the fissure had been practically filled in by new-formed bone. The line of fracture could no longer be traced in a lateral view of the head.



FIG. 9.—*Case 3.* At the eleventh month the only remaining evidence of the fracture was a slight break in the contour of the skull, so slight as to be manifest only upon roentgen examination. The child was perfectly normal in every way.



FIG. 10.—Indentation of the parietal bone without fracture in a child five and one-half months old, showing that such depressions may occur without fracture. Depression elevated by trephining the bone at the bottom of the depression and raising with a blunt hook. (Courtesy, Dr. William H. Lockett and the *Annals of Surgery*.)



FIG. 11.—*Case 4.* Depression of the right frontal bone, as a result of pressure of the brow upon the promontory of the sacrum during high forceps delivery, unaccompanied by symptoms of brain injury.



FIG. 12.—*Case 4.* Showing the result of the operation for the correction of the injury. An incision was made along the margin of the frontal bone at the coronal suture, a periosteal elevator passed along its under-surface and the depression thus elevated by upward pressure. The deformity was almost but not entirely corrected. (Case, Dr. A. B. Davis.)

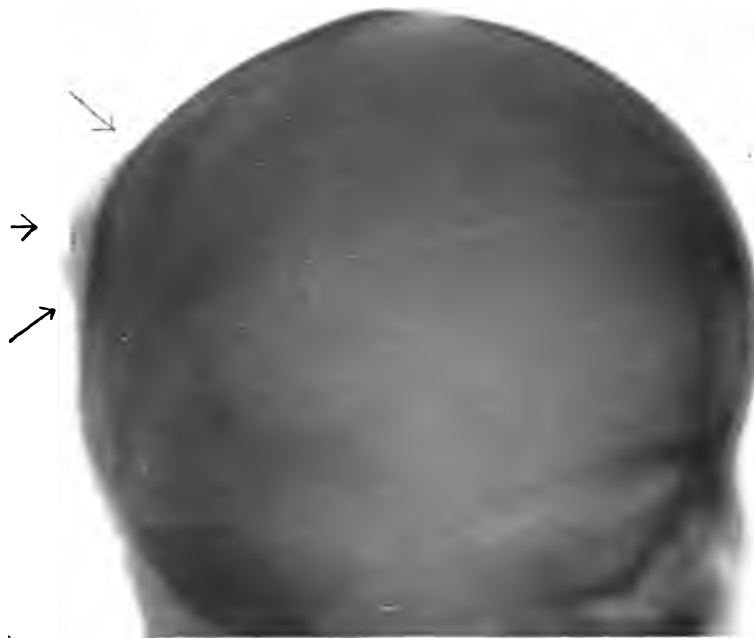


FIG. 13.—Case 5. Traumatic periostitis of the prominence of the parietal bone, due to bruising by the bowl of a forceps blade during instrumental delivery. An injury of this kind may result in a hard swelling upon the surface of the skull, appearing about the end of the first week after a forceps delivery, over which the scalp is freely movable, falsely suggesting a fracture of the underlying bone as its probable explanation.



FIG. 14.—Case 6. Excessive molding of the head in the new-born without fracture of the skull, in an infant delivered by Cæsarean section, the mother having been long in labor because of a deformed pelvis. The right parietal bone had dipped into the true pelvis while the left had been flattened upon the promontory of the sacrum. There was no brain injury, the child leaving the hospital in normal condition upon the twenty-sixth day.



FIG. 15.—Case 7. Excessive molding of the head in the new-born without fracture of the skull, a result of conditions similar to those in Case 6. The child was thought at first to be uninjured, but developed stupor, spasticity and finally convulsions, dying on the twenty-fifth day with definite symptoms of brain injury.



FIG. 16.—Case 7. Lateral view of the same case showed the degree of elevation of the right parietal bone and of compression of the other bones of the vault of the skull.



FIG. 17.—*Case 8* Excessive molding of the head in the new-born, a result of long, hard labor in a primipara, terminated by forceps delivery. The cranial bones were well developed, ossification well advanced to their margins. There was wide separation of the coronal, squamous and lambdoidal sutures, especially the last, which had the appearance of a bursting injury. There was no fracture of the skull, although the infant died of brain injury upon the second day.

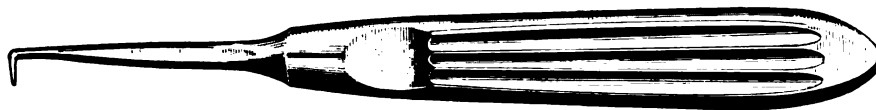


FIG. 18.—Instrument devised by Dr. George W. Kosmak, for the elevation of depressed fractures of the skull in the new-born. The sharp point is forced through the bone at the depth of the depression, turned parallel with its under-surface, and the deformity corrected by upward traction. This is accomplished without incision of the scalp or trephining the bone. The measurements of the hook are as follows, "total length, 6 inches; hook, inside measurement, 3-16 of an inch; the inner side must be flat and at a right angle to the shank." Instrument made by Kny Scheerer Co., N. Y.



FIG. 19.—Fracture-dislocation of the cervical vertebræ, showing the lesion usually found on roentgen observation following this injury. When difficulty is experienced in delivering the after-coming head in cases of breech extraction, either because of the size of the child, deformity of the pelvis, or an incompletely dilated cervix, this accident is a possibility to be borne in mind. It is usually produced by excessive extension of the neck combined with violent traction upward.

FRACTURES OF THE HUMERUS AND CLAVICLE

The bone most frequently broken during delivery is the humerus. Not even the clavicle is so liable to fracture. Unlike the clavicle, however, birth fractures of the humerus almost invariably attract the attention of the attendant and therefore rarely pass unnoticed, as do fractures of the clavicle occasionally. For this reason the relative frequency of the two injuries cannot be given with precision.

During the period of investigation of birth fractures, covering six years, there were 39 fractures of the humerus in 37 infants under observation. In two cases both humeri were fractured. Five of the thirty-seven infants had been delivered elsewhere, coming under observation, with or without treatment, when one week or more old. The thirty-two other cases were derived from the three divisions of The Lying-In Hospital. Fractures of the humerus occurring in infants still-born, or those dying within the first few days after delivery, have not been included in these figures. A number of these have naturally been met with and have had their share in shaping the opinions formed in the investigation of this injury.

As might be expected, some form of operative or forcible delivery has been the cause of the majority of these fractures. Twenty-four were produced during breech extraction following version, and six occurred during breech extraction in cases of breech presentation. Seven fractures were attributed to difficulty with the arms at the pelvic outlet in vertex presentations, while in two instances the cause of the fracture was never ascertained.

The site of the fracture was invariably at or near the center of the shaft of the bone, below the insertion of the deltoid muscle. In several cases a diagnosis was at first made of fracture of the surgical neck of the humerus, or of a supracondyloid fracture, but the roentgenogram has always failed to substantiate this opinion and these varieties of birth fracture of the humerus must be rare if they occur at all.

The line of fracture was transverse in all cases but one. This was probably due to the fact that the force producing the fracture was usually applied directly to the center of the humeral shaft and at right angles to it. In one

32 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

instance the line of fracture was somewhat oblique, an element of torsion entering into its production, as a fillet had been applied to the wrist of the arm injured, and traction maintained on this during version, thus twisting the arm across the back.

The type of injury suffered by the humerus in cases of extended arms may vary with the point at which the force is applied. Where the shoulders are high above the pelvic inlet and difficulty is experienced in passing the fingers upward to reach the arms, dislocation of the upper humeral epiphysis is possible. If the fingers can be passed well over the shoulder towards the middle of the arm, a fracture of the humerus at the usual site results when the necessary force is applied. When the shoulders come into the pelvis and, perhaps, the elbows are above the brim, with the shaft of the humerus splinted by the delivering fingers, the lower humeral epiphysis may be dislocated. This may explain the production of dislocations of the cartilaginous epiphyses, which are known to occur, while no fracture of the shaft of the humerus in the neighborhood of either epiphyseal line has yet been observed. The stronger expanded parts of the shaft of this bone in the region of its extremities are more resistant to injury than are the epiphyseal lines.

Birth fracture of the humerus is accompanied by some degree of deformity in almost all cases. This may be slight at first but often becomes considerable, either because of the activity of the infant or of the attempt to apply some complicated or inadequate method of treatment. Two types of deformity in the transverse plane were observed in the roentgenograms. The more common was a sharp outward angulation of the fragments of the broken bone; the second (infrequent) was a lateral displacement without angulation, the fragments parallel but separated. The angular deformities were so excessive in some instances as to be almost sensational, certainly of a degree rarely seen in an adult with similar fracture when presumably under treatment. Often the unsatisfactory condition of the fragments was not suspected until seen in the roentgenogram. The supposition has been rather general that these fractures in the new-born take good care of themselves, and on this basis have frequently not received the attention likely to be devoted to them when roentgen observations are available. Attention at first was so exclusively fixed upon the displacements in the transverse plane that the possibility of other deformities in the anteroposterior direction was not contemplated. When lateral views were made with the object of investigating conditions from this aspect it was found that while displacement in the anteroposterior plane was less common

than in the transverse, it did occur. An anterior angular deformity was found in some cases where in the treatment the elbow had not been brought forward by fixing the fore-arm of the injured side across the chest towards the opposite shoulder. Rotation of the lower fragment outwards was also seen, where treatment of the broken bone had been neglected, or was inadequately carried out. Over-riding of the fragments was unusual, as compared with fractures of the shaft of the femur, but was considerable in one case. Altogether the investigation of deformities in these fractures in the newborn was illuminating, and added much to the interest in treating and following up these cases.

The deposits of callus seen in the roentgenogram of birth fractures were of two varieties. At the point of fracture there was commonly noted a rather large and irregular mass of callus, sometimes almost foamy in appearance, evidently thrown out through a rent in the periosteum and perhaps occupying a space first formed by extravasation of blood at the time of the fracture. The second accompanying variety was the subperiosteal, formed along the surface of one or both fragments, with a sharp and usually straight line of limitation, due to the production of new bone beneath periosteum stripped up at the time of the injury. This deposit of callus was usually thickest at the point of maximum violence, tapering off in either direction. It was frequently seen extending to the very extremities of the bone.

The symptoms of birth fracture of the humerus are not different from those observed with a corresponding injury later in life. The arm hangs limp at the side. A false point of motion established at the center of the shaft of the bone may permit the arm to assume unnatural positions, while crepitus and swelling of the arm are usual. Ecchymosis is rarely observed.

Accompanying every case of birth fracture of the humerus there has been noted some degree of musculospiral nerve paralysis, indicated by a distinct wrist-drop. This was always present from the time of delivery, and so could not be explained by callus inclusion or even pressure of extravasated blood upon the nerve-trunk. The musculospiral nerve was exposed in three instances where the paralysis had been present following fracture and the infant had died of some complication during the first few days postpartum. There was no gross lesion of the nerve in the region of the point of fracture; there was a moderate amount of extravasated blood among the muscle planes and beneath the deep fascia; while the fractured ends of the bone were visible through a rent in the periosteum. The paralysis must be of

34 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

traumatic origin, due either to the violence producing the fracture or perhaps to bruising of the nerve by the ragged bone-ends that are so close at hand. The duration of the drop-wrist may be short, disappearing entirely in the first week, or it may persist for six or even eight weeks. In no case has it failed to clear up. Where paralysis has continued for several weeks the temptation may be offered to cut down on the nerve in the expectation of finding it lacerated and in the hope of restoring its continuity. Experience with this complication of these fractures warrants the opinion that operation should be deferred until the end of the third month at least.

An Erb's birth paralysis of the same arm was associated with the fracture of the humerus in three cases. This complication had no unfavorable influence on the repair of the fracture so far as could be determined, although in one of the cases it was certainly a contributing cause of the refracture of the bone. (Fig. 38.) As a birth fracture of the humerus commonly causes the arm to hang limp at the side for the first few days, evidence of involvement of the brachial plexus in the injury may escape detection. Where such force as to cause a fracture of the humerus has been employed to accomplish delivery an Erb's paralysis is always possible and should be looked for. Certainly it is the more serious of the two injuries.

When at the first opportunity an examination is made of the new-born child one or both arms may be found to dangle at the side of the body. There are six common causes for the dangling arm: it may be caused by a fracture of either the clavicle or the humerus; a dislocation of either the upper or the lower humeral epiphysis; by an Erb's birth paralysis; or finally by an active syphilis in the form of a specific periostitis, readily shown upon the roentgen plate. When it is discovered that an arm hangs motionless at the side in a new-born child the probable existence of some one of these conditions should be inquired into, and the correct diagnosis made. It sometimes happens that two of these lesions are met with in combination, and, on the other hand, some one of them may be unaccompanied by the usual apparent paralysis. A wide range of variation was observed in the cases studied.

In the treatment of birth fractures of the humerus it has been found that the simplest method is certainly the best. The infant arm is of such limited proportions that the application of any form of complicated apparatus has proven impracticable. Particularly has this been found true with various rigid splints, as of wood or metal. A splint of sheet aluminum was tried out but finally found to be too cumbersome. Several splints of wood intended

to be applied in the axilla and to immobilize the arm upon its under surface were devised and discarded. One in the form of the letter "V" was efficient but no better than simpler methods. This splint was deeply notched at the end of one side to fit up under the arm-pit, the point of the elbow rested at the point of the "V," while the flexed fore-arm rested upon the other side of the splint. The part of the splint beneath the arm proper contained two holes, situated at either side of the point of the fracture, through which a strip of adhesive plaster was passed to fix the fractured bone securely to the surface of the splint at the point where deformity was likely to take place in the opposite direction.

Too frequently these fractures have been treated by the application of small co-aptation splints of wood or card-board about the arm, without the necessary precaution of immobilizing the joints above and below the site of fracture. This has resulted in some of the more extensive cases of displacement which have undergone roentgen examination at a time too late to permit correction. The fresh fractures treated more recently have been put up without splints of any sort. After the application of a dusting powder, a square of folded gauze is placed in the axilla and under the fore-arm, the arm is pressed firmly against the chest wall, after manipulation, if necessary, to correct deformity, and the fore-arm placed across the chest towards the shoulder of the uninjured side. A swathe of adhesive plaster as wide as the distance from the tip of the shoulder to the tip of the elbow is attached to the chest wall in front and on the side opposite the fracture and passed under the arm of that side (Fig. 58) across the back and about the entire chest until overlapping, enclosing the injured arm in the position described. The fractured arm is thus pressed firmly against the lateral wall of the chest and fixed there, the chest wall itself acting as a splint. A Velpeau bandage of gauze is applied over the adhesive plaster swathe, and this in turn secured with several narrow strips of adhesive to maintain the dressing. The arm is then roentgenographed through the dressing to learn the position of the fragments and the dressing adjusted one way or the other if necessary. The gauze bandage should be removed every other day and the condition of the arm looked into. The adhesive swathe may require changing twice during the three weeks the dressing is worn, until union is firm. This method of treatment has been found efficient, is readily tolerated, and is about as simple as could be. It is intended, of course, as is any other method preferably, to be carried out under the guidance of the roentgen observations.

36 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

If but a single roentgen observation can be made during the treatment of these fractures, this will be found of greatest service at the end of the second week. At this time it is possible to correct deformities when noted. External angular deformities following treatment, or found in untreated cases, may be completely eliminated by the manipulation of the injured arm, nor is a deformity corrected after the point of fracture has become surrounded by the callous mass but before actual union has taken place, so prone to displacement as is a fresh fracture. How long this opportunity for the correction of undesirable displacements will remain open varies somewhat. Deformities can readily be eliminated several days after the appearance of the callous mass in the roentgenogram which ordinarily appears between the eighth and the twelfth days.

The presence of deformity after firm union has taken place is not of such importance in cases of birth fracture of the humerus as in cases of fracture of the femur. This has been determined by the study of cases of persistent deformity following each variety of fracture. Three-quarters of all cases of fracture of the humerus have shown some degree of deformity at the end of the first month. Fortunately most of these have been slight. In a few cases the external angular deformity has been excessive. Some of these have been untreated cases, coming under observation after firm union had occurred; a few cases presented deformities in spite of persistent efforts to prevent them by the method of treatment thought suitable at the time. These cases of residual deformity have been followed with the greatest interest, and have been roentgenographed at intervals over periods of months or years as required, until the deformities have been proven to have disappeared. When the investigation of birth fractures was in its earlier stages the temptation to refracture or even cut down upon these bones, so excessively distorted, was great. It was then believed that a permanent deformity of excessive degree could not be avoided in any other way, and that these patients would carry through life visible evidence of the inefficiency or incompetence of the treatment of their birth injury. There was even some basis for the supposition that this deformity would become exaggerated during childhood, since a bone angulated at its center and lengthening by growth at its extremities might display a constantly increasing departure from normal as it approached adult dimensions. The serial roentgenograms made in these cases during the first three years of life have shown in every instance a progressive elimination of the deformity following birth fracture of the humerus.

In no case has the original deformity been so excessive that union has failed to take place. When union has occurred with deformity, no deformity has been observed of such a degree that nature has been unable to restore the bone to a condition that compares most favorably with the uninjured humerus of the opposite side. When time has been insufficient to complete the observations, the bone has always been well on its way toward restoration. Nature's ability to accomplish this has been proven remarkable. As the successive pictures of the several cases have been made, surprise has given way to admiration for the unseen but unerring influence steadily at work modeling a straight bone from a deformed one. The pictures presented showing the several types of displacement following birth fracture of the humerus are those most marked in degree in each instance and are reproduced more with the idea of showing what may occur and can be recovered from, than to justify any failure to treat these cases in the best way possible. Even if nature can be relied upon to compensate for deficiencies of treatment in these cases, these fractures are entitled to as careful and efficient treatment as are any others and every effort should be made to reduce a fresh fracture of the humerus in the newborn as completely as in an adult and to immobilize it in the best possible position until firm union has been attained.

Between twenty-five and thirty cases of birth fracture of the clavicle have been under observation. This injury has not been so closely followed as have the fractures of other bones. They have not presented so much of interest as have the fractures of the humerus and the femur. The majority have been produced during more or less difficult breech extraction, sometimes preceded by version. In four cases both clavicles were broken and in one of these in conjunction with fractures of both humeri. The site of fracture has been regularly near the center of the bone, the line of fracture nearly transverse, and the displacement much like that observed in adults with the same injury. The inner fragment is pulled upward while the outer drops downward and often inward. In no case has a so-called green-stick fracture been observed. The disturbance caused by a birth fracture of the clavicle may be slight. The affected arm may hang at the side, or may be used much as though no fracture had occurred. For this reason it is not uncommon for the fracture to escape notice until the appearance of the callous mass over the point of fracture (often first noticed by the mother) gives the first indication that a fracture of the clavicle had occurred during delivery.

When the fracture is single, treatment has been carried out with a simple

38 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

Velpeau bandage. After the application of a dusting powder, the skin of the arm and axilla is protected by a square of interposed folded gauze, and the shoulder-girdle of the injured side is immobilized by means of a snug Velpeau fixed in a position similar to that in fracture of the humerus. When both clavicles have been fractured a figure-of-eight bandage across the back which draws both shoulders well backward has been serviceable. Union has been firm in three weeks and in no case has union failed to take place.



FIG. 20.—Birth fracture of the clavicle, showing the usual site of the fracture, with the usual displacement, similar to that seen in the adult. These fractures, sometimes unobserved until the development of the callous mass, repair quite promptly with simple fixation of the arm and shoulder-girdle, without resulting deformity or disability of any sort.



FIG. 21.—Birth fracture of both clavicles, a not uncommon variety of birth injury, usually produced during difficult breech extraction with arms extended above the head. When both clavicles have been broken the figure-of-eight bandage about the shoulders and across the back is a convenient and efficient dressing.



FIG. 22.—*Case 1.* Birth fracture of the humerus, first referred for roentgen examination after firm union had taken place, showing the callous mass about the fracture, with the fragments fixed in extreme external angulation. No attempt was made at this time to correct the deformity, the case being kept under observation.

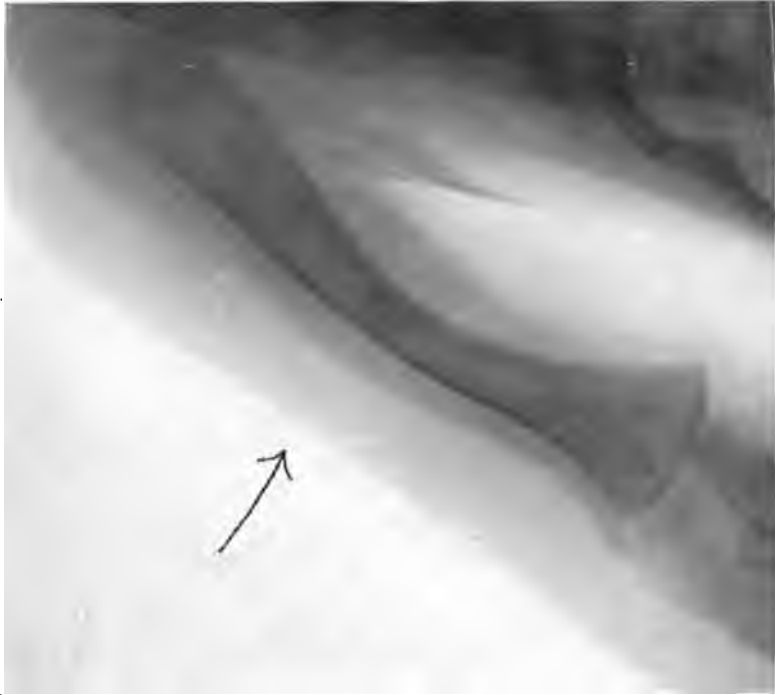


FIG. 23.—*Case 1.* At the eighth month and without treatment, nature had done much to correct the deformity, changing an excessive external angulation to a moderate external curvature.



FIG. 24.—Case 1. At the eighteenth month even the curvature had been largely eliminated, the medullary canal reestablished, while the development of the bone had been unimpaired.

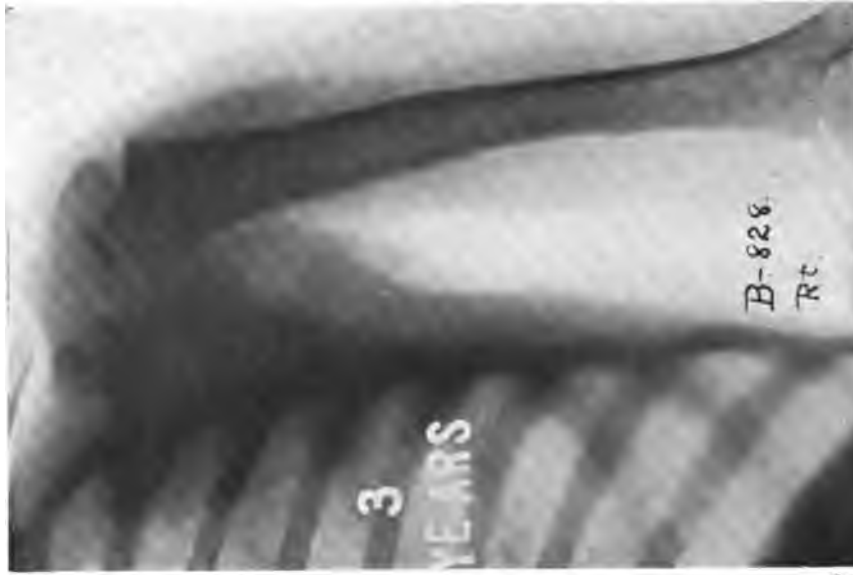


FIG. 25.—Case 1. At the end of the third year roentgenograms of the injured and the uninjured humeri revealed little disparity. The bones were of the same length, functions of both arms were normal in every way, while the injured bone still presented a suggestion of outward curvature, insignificant when compared with the original extreme deformity. (Roentgenogram transposed by use of screen.)



FIG. 26.—*Case 2.* Birth fracture of the humerus roentgenographed through the dressing at the end of the second week. External angulation of the fragments, the usual type of deformity, had occurred. Callous formation was well advanced.

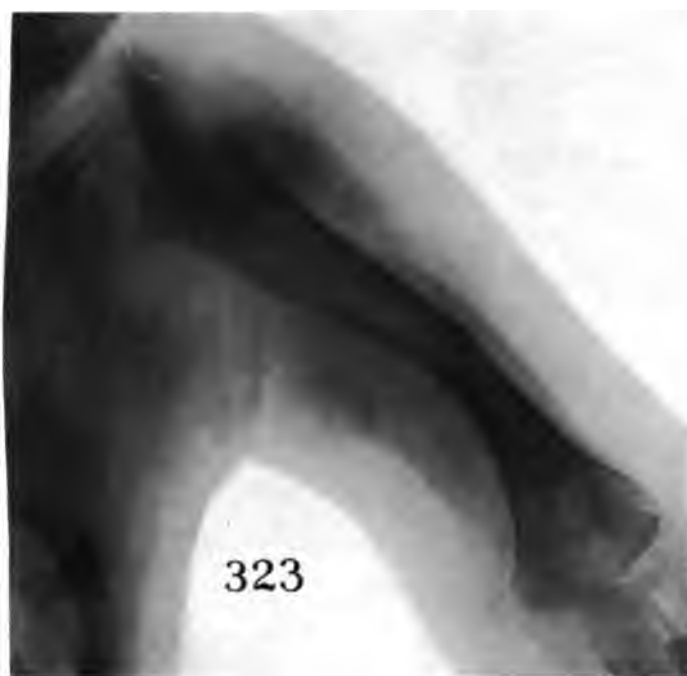


FIG. 27.—*Case 2.* At the seventh month and without treatment an outward curvature had replaced the original angular deformity.



FIG. 28.—*Case 2.* Two years after injury all deformity had disappeared, the humerus being indistinguishable from its fellow of the opposite side. It is only when the deformity has been excessive that evidences of the fracture are likely to persist beyond the second year.

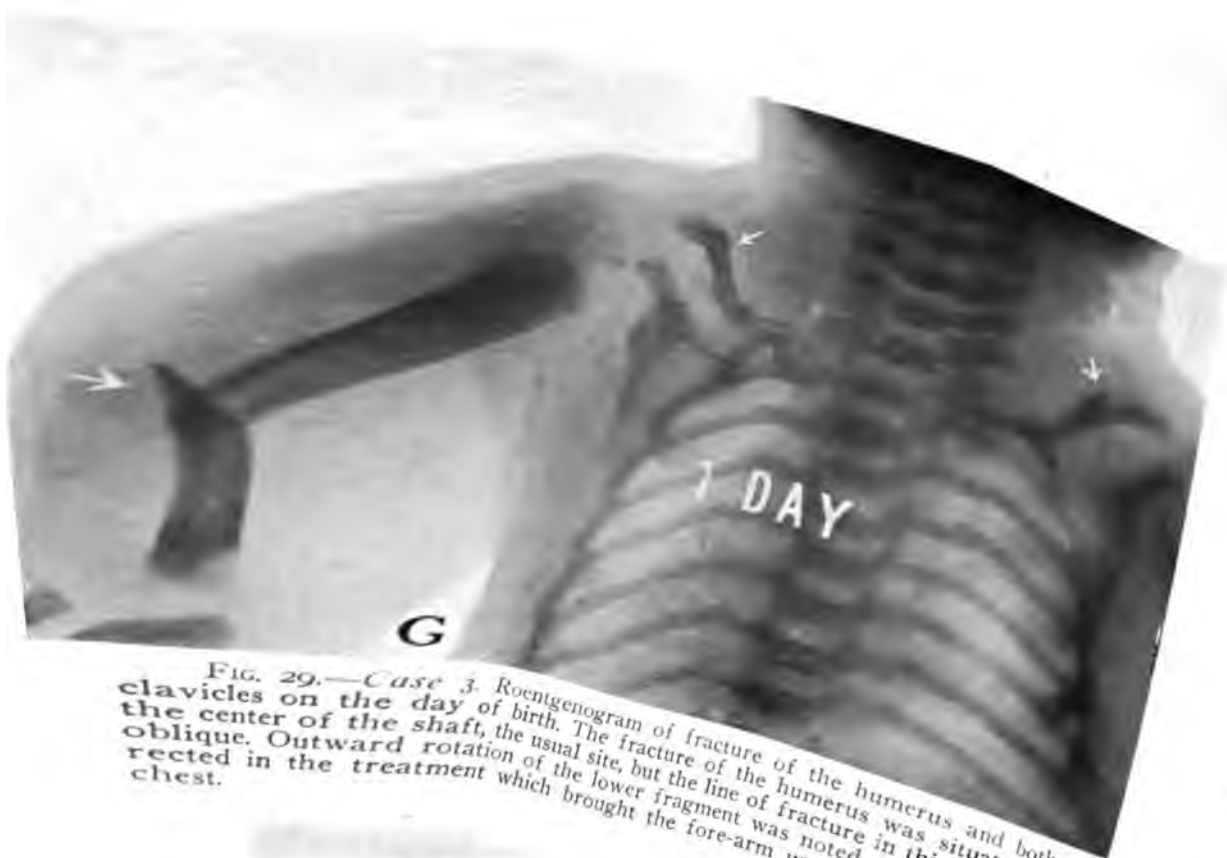


FIG. 29.—Case 3. Roentgenogram of fracture of the humerus and both clavicles on the day of birth. The fracture of the humerus was situated at the center of the shaft, the usual site, but the line of fracture in this case was oblique. Outward rotation of the lower fragment was noted, afterward corrected in the treatment which brought the fore-arm upon the front of the chest.



FIG. 30.—Case 3. One month after injury union had taken place with an excessive degree of deformity. No attempt was made at this time to correct this, as previous similar cases had demonstrated nature's ability to deal successfully with these distortions.



FIG. 31.—*Case 3.* Two months after the previous observation the angulation was found to have been transformed into an outward curvature, as in other cases of similar deformity. The restoration of the medullary canal was well under way.



FIG. 32.—*Case 3.* Roentgenogram at the end of the eighth month showed the satisfactory repair of the fractured clavicles. There was some decrease in the curvature of the injured humerus. (Screen picture.)



FIG. 33.—Case 3. Progressive elimination of the deformity was observed in the roentgenogram at the fourteenth month. The improvement had been gradual but evidently constant, justifying the adoption of conservative treatment in these cases of extreme deformity following birth fracture of the humerus.



FIG. 34.—Case 3. At twenty-one months of age nature had almost completed the correction of the deformity of the fractured humerus. There had been no treatment since the removal of the dressing at three weeks of age. The child was lost sight of after this observation, but the final outcome was quite definitely assured. The arm had developed normally; there was no impairment of function.



FIG. 35.—*Case 4.* Untreated birth fracture of the humerus of two weeks' standing. New bone had already been developed about the point of fracture, there was fairly firm union, while the displacement was the most extreme of any observed among the cases of birth fracture of the humerus.



FIG. 36.—*Case 4.* As a result of the roentgenogram made at the end of the second week an attempt was made to correct the deformity by manipulation of the injured arm. The result of this correction was not checked up by a second roentgenogram immediately afterward, as is desirable when possible. At the end of eight weeks a well-marked outward curvature of the fractured humerus was noted. This was not so extreme as had been expected, considering the degree of the original deformity.



FIG. 37.—*Case 4.* Nine months after injury the bone was found well on its way towards restoration to normal. There was marked decrease in the outward curvature, while the medullary canal had been reformed.



FIG. 38.—*Case 5.* Birth fracture of the humerus associated with Erb's birth paralysis, an occasional complication. Roentgenogram on the eighth day. There was a slight outward angular deformity, while the callous mass had already made its appearance in the roentgenogram.



FIG. 39.—*Case 5.* Union was neither delayed nor impaired. At eleven months the humerus presented a slight outward curvature, rarefaction of the entire shaft was noted, there had been no improvement in the paralysis.



FIG. 40.—*Case 5.* A slight fall caused a refracture of the humerus two weeks after the last observation. The second fracture was a reproduction of the first, both in site and variety.



FIG. 41.—*Case 5.* Union took place the second time, though tardily. The resulting deformity, shown at the second year, was greater than after the original fracture. There had been no improvement in the paralysis.



FIG. 42.—*Case 6.* Roentgenogram of birth fracture of the humerus in the dressing on the eighth day, showing the second and less common type of deformity in the transverse plane, lateral displacement of the lower fragment.



FIG. 43.—*Case 6.* Roentgenogram at the end of the second month showed a large interposed deposit of new-formed bone uniting the fragments of the broken humerus. The outline of the original fragments was still quite evident.

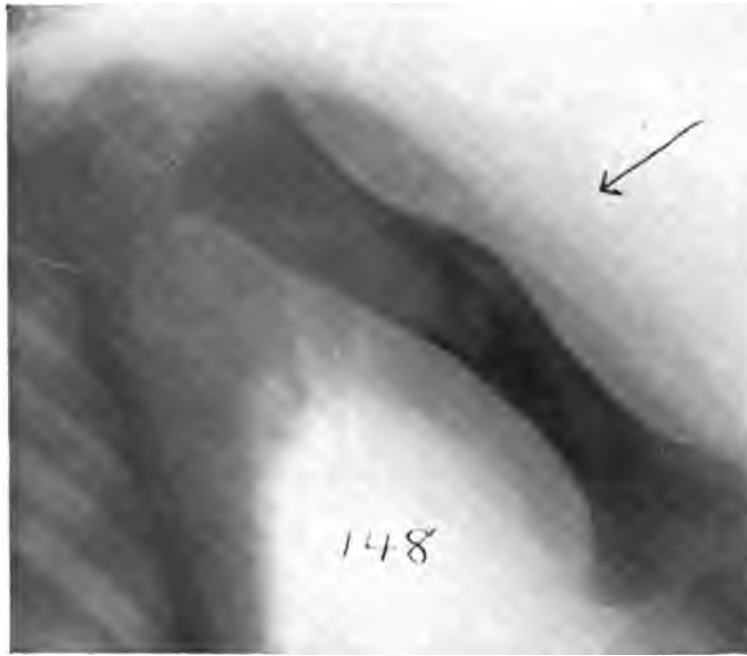


FIG. 44.—*Case 6.* At four and a half months there was marked improvement in the deformity, superfluous bone had been absorbed, the lateral displacement was no longer evident, and the medullary canal was in the process of restoration.



FIG. 45.—*Case 6.* At fourteen months the injured humerus was found to have nearly straightened out. Comparison with the humerus of the other arm was favorable, and all measurements and functions of the arms were equal.



FIG. 46.—*Case 7.* Roentgenogram of infant on day of birth, showing fractures of both clavicles and both humeri, a result of version and difficult breech extraction. Treatment consisted in flexing each fore-arm to a right angle with the arm behind the back, over which was applied a light plaster of Paris jacket embracing the upper trunk and shoulders.



FIG. 47.—*Case 7.* Picture of the same case eleven months later. There remained no evidence of the fractures of the humeri, which were found straight and equal. The clavicles showed slight irregularities, without actual deformity, indicating the points of fracture.

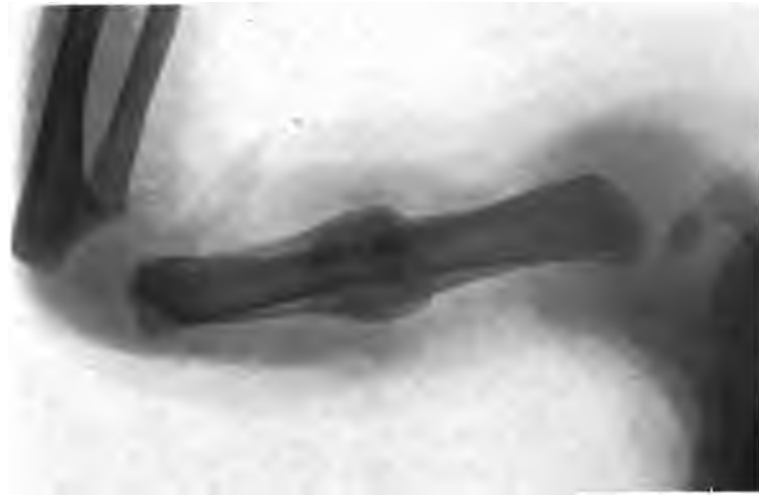


FIG. 48.—*Case 8.* Lateral view of birth fracture of the humerus at the fifth week, showing absence of deformity in the anteroposterior plane. The point of fracture is surrounded by a globular mass of new-formed bone, while deposits of new bone are seen beneath the periosteum, which has been stripped from the surface of the fragments practically to their extremities. Deformities are less frequently discovered in the lateral views of fractured humeri than in the anteroposterior.



FIG. 49.—*Case 9.* Lateral view of birth fracture of the humerus at the fifth week, showing anterior angular deformity. The deformity is being eliminated by the new-formed bone deposited in large quantity upon the posterior surfaces of the fragments.



FIG. 50.—*Case 10.* Lateral view of birth fracture of the humerus, at the third week, showing over-riding of the fragments. Over-riding of the fragments is usual in birth fractures of the femur, but is uncommon in such fractures of the humerus. Both subperiosteal and subfascial varieties of new-formed bone are well shown in this picture.



FIG. 51.—*Case 11.* Anteroposterior view of birth fracture of the humerus at the fourth week, showing an unusual variety of deformity, outward rotation of the lower fragment. Union was firm, while the lower fragment was found to have rotated outward upon its long axis through ninety degrees.



FIG. 52.—*Case 12.* Treatment of birth fracture of the humerus. The roentgen examination of a case first coming under observation on the thirteenth day showed a well-marked external angular deformity, with a well-developed callous mass surrounding the point of fracture. Although union was quite firm, an attempt was made to straighten the bone by manipulation of the injured arm, and a swathe dressing then applied.



FIG. 53.—*Case 12.* The picture, taken through the dressing immediately after this procedure, showed a very definite improvement in the condition of the fractured humerus.



FIG. 54.—*Case 13.* Treatment of birth fracture of the humerus. A second case of excessive external angular deformity coming under observation two weeks after injury, with firm union and a well-developed callous mass surrounding the point of fracture, was treated by manipulation of the affected arm, the object being to obtain alignment of the fragments of the broken bone.



FIG. 55.—*Case 13.* The roentgenogram, made immediately after this endeavor, showed a very satisfactory improvement in the condition of the fracture. These cases show that when early treatment has proven unsatisfactory or when cases are seen for the first time in the second or third week, even in the presence of advancing union, and a considerable callous mass, the opportunity still offers to correct the more excessive persistent deformities.

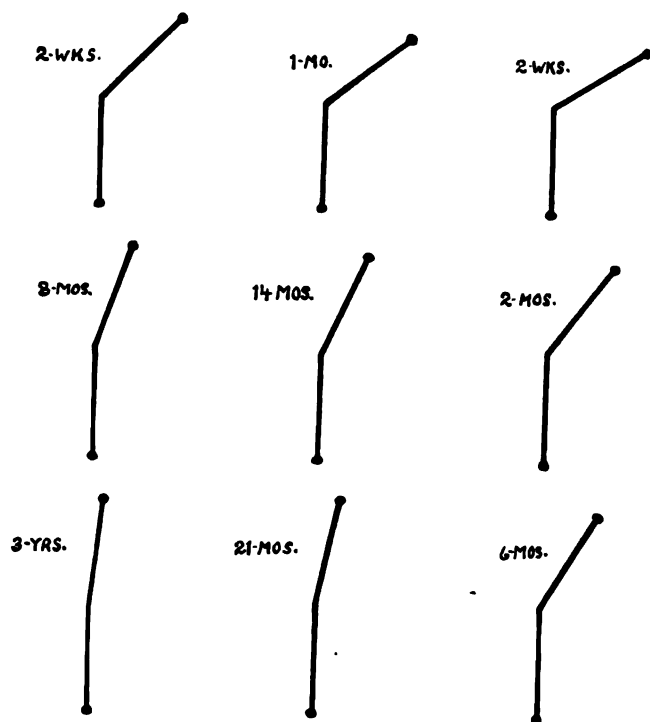


FIG. 56.—Diagram made with the object of showing the degree of initial angular deformity existing in cases of birth fracture of the humerus with excessive displacement of the fragments and the subsequent progress towards elimination of the deformity by nature. The lines going to form the angles represent the long axes of the fragments of the fractured bones, converging towards the point of fracture. An initial deformity of forty-five degrees or more may eventually result in a perfectly straight bone at the third year. Diagram made from tracings of roentgenograms of *Cases 1, 3 and 4*. The first vertical column from *Case 1*, the second from *Case 3*, the third from *Case 4*, still under observation.



FIG. 57.—Dissection of birth fracture of the humerus from a case dying on the third day having the usual musculospiral paralysis. The deltoid muscle has been cut away at its insertion to the humerus and the nerve exposed as it passes the point of fracture. No gross injury to the nerve was found in this or two other cases so examined. The upper end of the lower fragment can be seen protruding from the rent in the periosteum.



FIG. 58.—Method of treatment of birth fracture of the humerus. After experimenting with various splints of wood and metal, and with the arm in various positions, it has been found that a simple swathe dressing fixing the broken arm to the chest wall, with the fore-arm held in flexion, is as satisfactory as any. After applying a dusting powder to the axilla a square of folded gauze is placed beneath the arm and a swathe of adhesive plaster as broad as the distance from the point of the shoulder to the tip of the elbow is passed about the chest, fixing the injured arm and fore-arm firmly to the chest wall.

FIG. 59.—Over the adhesive plaster swathe is applied a Velpeau bandage of gauze. This, in turn, is secured by several narrow strips of adhesive plaster, which serve materially to maintain the dressing. Roentgenograms made through the dressing will assist greatly in the proper application of this method of treatment. The arm is immobilized for three weeks.

FRACTURES OF THE FEMUR

The most interesting of the birth fractures are the fractures of the shaft of the femur. Their relative infrequency, their tendency to excessive deformity, and the various problems presented in their treatment have all served to attract particular attention to them.

During a period of six years only thirteen cases of birth fracture of the femur have come under observation, two of these having been derived from outside sources.

Eight fractures were incidental to breech delivery. Of these, three femora were broken in cases of frank breech presentation while the injured extremity was still within the uterus, and one more by torsion of the leg within the vagina, a case of footling. Four others occurred after the delivery of the infant's body by too vigorous manipulation during difficult extraction of the after-coming head. Two of these cases were simple breech extractions and in two the breech extraction had been preceded by version. Three of the remaining five fractures were produced while extracting the child through the uterine incision during Caesarean section and one by a mid-wife who swung the new-born child by its leg to induce respiration. In one instance the cause of the fracture was never determined.

The site of fracture in all cases was near, or somewhat above, the center of the shaft of the bone. In six cases the line of fracture was practically transverse, in six oblique, while one case was first roentgenographed long after indications of the line of fracture had disappeared. The cases showing the greatest degree of obliquity were those produced during extraction of the infant through the uterine incision. In these the bone was broken directly across the finger, the infants were large, the uterine muscle thick, the incision perhaps insufficient. Where the opportunity was afforded for early roentgen examination it was found that separation and displacement of the fragments in various directions had been present from the first. This displacement resembled that commonly observed in adults. The pull of the muscles attached to the upper fragment produced flexion of that portion of the bone, thus causing the most important feature of the displacement, an anterior angulation. Combined with this flexion of the upper fragment there was

usually noted a marked tendency to external angulation, with more or less over-riding of the fragments.

Considerations of immediate and remote deformity enter into the problem of the treatment of cases of birth fracture of the femur for the reason that deformities uncorrected in the early treatment of these fractures have been found to persist long after deformities of corresponding degree have disappeared in cases of birth fracture of the humerus. Almost any method of treatment will seem satisfactory in the absence of roentgen observations, which too often sweep away the confidence at first reposed in the particular form of treatment employed. Very little difficulty will be found in obtaining alignment of the fragments of the broken bone as seen in the anteroposterior view, while the lateral views, which are so essential in these cases, will almost invariably show an excessive anterior angular deformity very difficult to correct.

All lateral views of these fractures that have been treated without this consideration prominently in mind have shown the result of this uncorrected displacement, both early and late. The disinclination on the part of nature to compensate for deficiencies of treatment in these cases throws added responsibility on the surgeon who is called upon to care for them. Any form of treatment must be regarded as a failure that starts a child out in life with a distorted bone if such a consequence is in any way avoidable.

Text-books on either obstetrics or surgery offer little really helpful information on this subject, nor do the periodicals yield much more. Jones¹ of Liverpool, reporting twenty cases, mentions the difficulties presented, and advocates the employment of a modified Thomas knee splint. He also speaks of one case operated upon.

Robins² of Richmond, Va., comments on the barrenness of the literature on this subject, admits the difficulties of treatment, mentions five cases of birth fracture of the femur among colleagues and presents a clever splint of bent wire invented to meet the requirements of a case of his own. He presents two roentgenograms of his case, a lateral view taken in the splint, and a six months' picture taken in the anteroposterior direction. Da Costa³ in his text-book on surgery recommends the Van Arsdale splint, or Dr. Martin W. Ware's⁴ modification of it, in cases of birth fracture of the femur, a very practical method of treatment.

In the cases now presented the treatment was modified as experience accumulated. The first birth fracture of the femur presenting itself was of

62 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

four weeks' standing. The roentgenogram (Fig. 68), made in the anteroposterior direction, disclosed considerable external deviation of the fragments. Misled by the experience derived from observation of numerous earlier cases of fracture of the humerus it was fallaciously assumed that the only deformity of importance would be found in a transverse plane. The thigh was straightened by manipulation, and the fracture treated in extension by means of a long side-splint, reaching from the axilla to below the sole of the foot, so arranged as to afford traction as well. Six weeks elapsed, and during this time a case of birth fracture of the femur that had occurred eighteen months before was sought out and the injured member submitted to roentgen examination. The anteroposterior view was entirely creditable (Fig. 60), while the lateral showed an extreme anterior curvature of the shaft of the fractured femur. (Fig. 61.) This case had been treated by means of coaptation splints applied about the thigh with bandages, little significance being attached to the injury at the time. A lateral view was immediately made of the case under treatment, which revealed a pronounced anterior angular deformity (Fig. 70), a foreboding of the deformity that is now shown to exist at the end of the third year. About this time one of the contributed cases of birth fracture of the femur (Courtesy, Dr. Frank S. Mathews), sixteen months of age, was roentgenographed for investigation. A deformity similar to that found in *Case 1* was disclosed. (Fig. 66.) This patient, too, had been practically untreated for seven weeks, when it first came under surgical care and the first roentgen observations were made.

The experience gained from these three cases led quite naturally to the conclusion that in the treatment of this injury too much care could not be devoted to the correction of the anterior displacement and furthermore brought about the conviction that any method of treatment which held the leg in extension was incompetent. The normal attitude or position of the newborn child is one of general and acute flexion, while all efforts to alter this position are vigorously resisted by the infant. For this reason alone the treatment of this condition is more naturally and reasonably carried out with the thigh in some degree of flexion. Having discarded the long side-splint with traction, the Van Arsdale splint was taken up. (Fig. 116.) This is a triangular splint with two gutter sides, one for application to the side of the body, the other to the injured thigh. The application of this splint brings the thigh to a position of flexion at a right angle with the body, thus raising the lower fragment to a level with the flexed upper. The splint is well tolerated, permits

cleanliness, and makes possible the transportation of the patient to its mother at the regular intervals for nursing. On the other hand there is no provision for traction, and it was soon found that the upward pull of the muscles uniting the fragments produced considerable over-riding of the parts in the first few days of treatment, with consequent shortening of the thigh. Nor did this splint remove altogether the anterior angular deformity. It was found in the roentgenograms that in some cases the lower fragment was held parallel with the surface of the splint, while the upper fragment departed from the alignment desired because of the muscular action so constantly exerted upon it. This condition of the fragments while under treatment with the Van Arsdale splint is well shown in Figs. 79 and 91. Without the evidence presented by the roentgen examinations there would be no reason to suspect that this splint did not meet all the requirements of these cases.

While the treatment of birth fracture of the femur by the Van Arsdale splint presented definite advantages over the long side-splint with traction at first employed, it was felt that some other method still better might be devised. The condition of these fresh fractures when coming under observation called for the correction of the displacements usual in corresponding fractures in adults, that is, angular deformity, both forward and outward; the probable tendency to over-riding of the fragments, more troublesome after the first few days than at the time of injury; and finally the possibility of some degree of rotation of the fragments of the broken bone. In addition the satisfactory treatment of infants must include ample opportunity for cleanliness as well as permit the transportation of the patient, apparatus and all, to its mother at intervals for nursing.

With these requirements in view the box splint was gradually evolved (Fig. 117), and so far as the opportunity has been afforded for its application has seemed the most satisfactory routine method of treatment for these cases.

The infant is placed on its back in a cushioned box, into which it fits snugly. A broad band of adhesive plaster or webbing is passed across the abdomen and around the box, to afford counter-traction; two strips of adhesive plaster, each a little less wide than half the circumference of the thigh, are applied to the leg from just above the point of fracture to the ankle and held in place by a firm roller bandage of gauze. The lower ends of these plaster strips are cut and folded upon themselves to form narrow straps of some strength, suitable for passing through the holes in the foot-

64 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

piece. These are drawn up snugly and secured so that the sole of the foot is brought flat against the surface of the foot-piece, thus controlling the tendency to drop-foot.

The foot-piece itself is attached to a length of cord or stout tape; this is passed over the pulley at the top of the upright, and tied to a large elastic band caught over the hook at its base, which is intended to afford the necessary amount of traction. Two webbing bands with buckles, which are tightened as necessary to bring the fragments into the desired position, are passed about the injured thigh and the upright, one above and one below the point of fracture. The box-splint offers flexion of the thigh to a little less than a right angle, which should bring the lower fragment of the femur into such a position as to meet the upper without angulation, thus correcting the undesirable anterior deformity; it offers abduction of the leg, preventing outward angulation; over-riding is prevented by such traction on the leg as may be required; the broad base of the foot-piece resting upon the surface of the upright prevents rotation of the leg, and thus the occurrence of rotary deformity of the fragments. The opportunity for cleanliness is amply afforded and the infant can be transported, box-splint and all, from place to place, as the requirements of nursing may demand. With proper care, treatment can be continued for four weeks in this way.

While thirteen cases of birth fracture of the femur may be insufficient to furnish general conclusions, certain features, more or less common to all, deserve comment. It may be assumed in all cases that the fracture is not only complete but that there is considerable accompanying displacement. Where a roentgen examination can be made, this opinion will probably be amply substantiated. The displacement is associated with laceration of the periosteum, often extensive, and sometimes further complicated by invasion of the muscles of the thigh by the end of one or both fragments. This condition is brought about by the continuation of the trauma after the production of the fracture, and is peculiar to the circumstances under which these fractures are ordinarily sustained.

Appropriate treatment includes traction upon the thigh, immobilization of the joints above and below the affected bone, with pressure applied about the injured thigh to approximate the fragments of the fractured femur, particularly to maintain some degree of extension of the upper. This can be accomplished by the box-splint, in which the infant can be kept with comfort for three or more weeks, and which should offer some assurance of

a satisfactory outcome in the usual case. The Van Arsdale splint will effect approximation of the fragments in cases where other means fail, particularly when modified to form less than a right angle between body and thigh, but offers no opportunity to overcome over-riding and may fail to obliterate anterior angular deformity.

The dressing will require frequent changing whatever method is employed. The condition of the skin should be watched closely, pressure spots looked for, and the splint readjusted as necessary, all splints being difficult to maintain during infancy. Frequent roentgen observations are of great value, showing either that a satisfactory reduction is being maintained, or that the present treatment is inadequate. Undoubtedly some of these fractures are extremely difficult or even impossible to satisfactorily reduce by manipulation alone, because of the original displacement, portions of the soft parts sometimes intervening. Failure to accomplish reduction will result invariably in an anterior curvature of the femur, persistent throughout childhood at least, but apparently without causation of disability. This curvature is consequent upon an original anterior angular deformity, caused, in turn, by the flexion of the upper fragment. A short upper fragment is more apt to escape control during treatment than is a long one, while the tendency to acute flexion seems more pronounced in cases of frank breech presentations than in others. While these fractures may be compound, this complication is rare. Open operation for the reduction of the displacement is scarcely justifiable in cases of birth fracture of the femur. The difficulty in maintaining asepsis and the risk of infection are too great to justify operation for the prevention of a deformity unaccompanied by disability, however persistent.

Although birth fracture of the femur is frequently the product of the inexperienced and the maladroit, greater care in the delivery of breech presentations and the performance of breech extraction may often result in sparing the infant this unfortunate complication.

Even limited experience is sufficient to indicate the desirability of avoiding an injury so difficult to deal with at the time and characterized by such intractable tendency to persistent deformity.

REFERENCES

- ¹ JONES. *Brit. Med. Jour.*, 1908. Vol. I, p. 1358.
- ² ROBINS. *Surg., Gynec. and Obst.*, Feb., 1908.
- ³ DA COSTA. "Textbook of Surgery," 7th edition.
- ⁴ WARE. *Ann. Surg.*, Aug., 1905.
- ⁵ RUSSELL AND REYNOLDS. *Jour. Am. Med. Assn.*, June 23, 1917.



FIG. 60.—*Case 1.* Birth fracture of the femur treated without roentgen facilities, roentgenographed for the first time at the age of one and one-half years. There was slight thickening, with outward curvature, of the upper part of the shaft of the affected bone.



FIG. 61.—Case 1. The lateral view of the same case showed an extreme anterior curvature of the injured femur, which could also be felt on examination of the thigh.



FIG. 62.—*Case 1.* Further observations made at the end of the third year still showed the thickening of the shaft of the bone in the region of the old fracture. (Postero-anterior view.)



FIG. 63.—*Case 1.* The lateral view of the same bone at the termination of the third year indicated the persistent nature of the deformity, little improvement being noted since the examination of eighteen months before. Whatever tendency there might have been towards elimination of the curvature was undoubtedly limited by the accompanying rachitic condition and marked coxa vara. (Picture transposed by use of screen.)

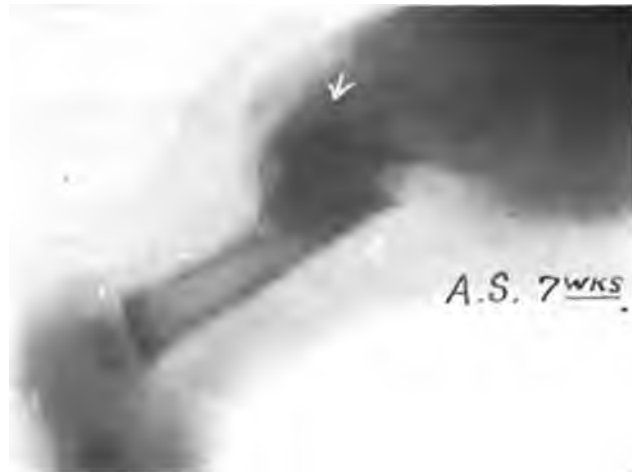


FIG. 64.—*Case 2.* Case of birth fracture of the femur first coming under treatment and roentgenographed at the seventh week. Union was already firm, with the fragments fixed in a position of marked anterior angulation. (Courtesy, Dr. Frank S. Mathews.)



FIG. 65.—*Case 2.* Anteroposterior view of the same case at the sixteenth month. As in *Case 1*, there was slight thickening with outward curvature of the affected femur in the region of the old fracture. The slight outward curvature persisting in *Cases 1* and *2*, and shown in Figs. 60 and 65 represent the original and uncorrected outward angular deformity.

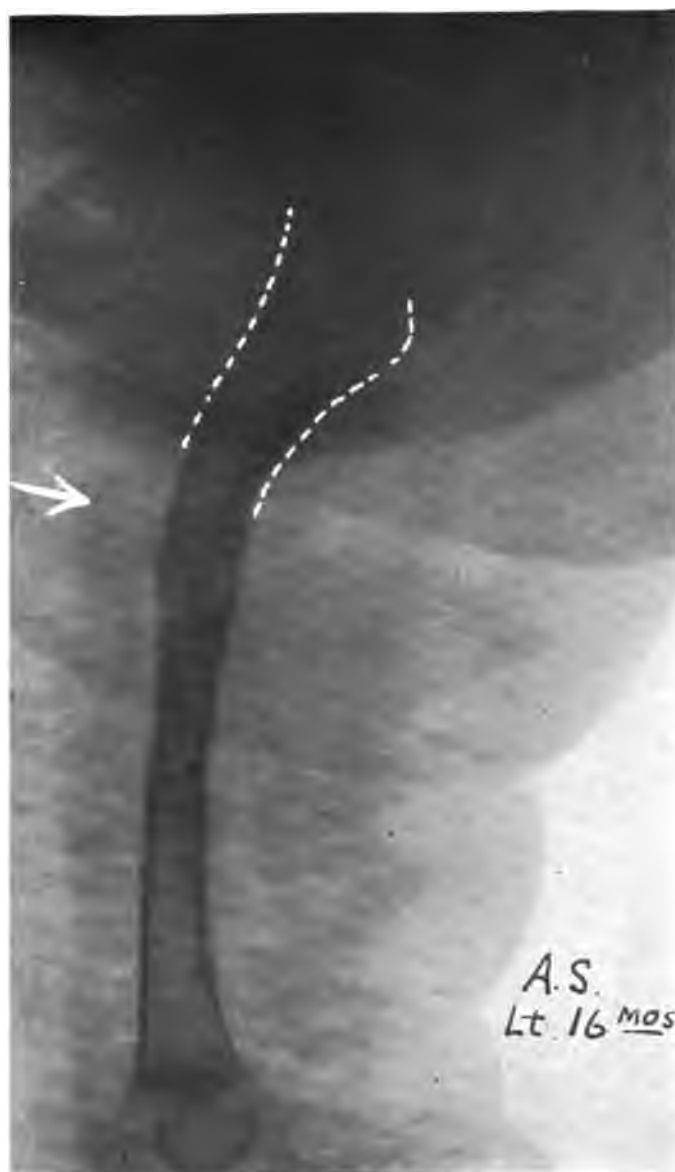


FIG. 66.—*Case 2*. The lateral view of the same case at the sixteenth month, showing the anterior curvature, which had been expected, as a result of the displacement at first observed, and corresponding with that seen in *Case 1*, Fig. 61.



FIG. 67.—*Case 2.* In the lateral view at the end of the third year the anterior curvature was found to exist much as before. It will be noted that in the lateral views of the two cases shown at three years of age, the curvature representing the old fracture is situated at the juncture of the upper with the middle third of the shaft of the bone, while the point of fracture was originally near its center. This apparent shifting upwards of the deformity resulting from these fractures is due to the fact that the preponderance of the growth of the bone takes place at the lower epiphyseal line.



FIG. 68.—*Case 3.* Untreated birth fracture of the femur seen for the first time at the age of four weeks. The anteroposterior view showed a marked outward angular displacement of the fragments. The femur appeared much shortened in the picture, which might at first be attributed entirely to the outward displacement, but which is really a foreshortening produced by the anterior deformity, a point not at first appreciated.



FIG. 69.—*Case 3.* Postero-anterior view of the same case two weeks later. The outward displacement of the fragments had been partly corrected by manipulation of the thigh, the point of fracture was surrounded by a large and dense callous mass. At this time no lateral view had been made.



FIG. 70.—Case 3. A lateral view made for the first time at the tenth week disclosed the more important deformity, an excessive anterior angulation. The fragments were widely separated, over-riding was present, while a large and dense mass of interposed callus fixed the fragments in a most undesirable position. Figs. 64 and 70 present the usual picture seen in cases of birth fracture of the femur where there has been no treatment or where treatment has not been formulated with the aim to overcome this important and constant deformity.



FIG. 71.—Case 3. At the eighth month the anterior angular deformity had begun to assume the usual anterior curvature, characteristic of these fractures when the original anterior angulation has remained uncorrected.



FIG. 72.—*Case 3.* The anterior view of the injured femur at the eighth month presented but slight abnormality. There was slight thickening, with outward curvature, but the result from this point of view was satisfactory.

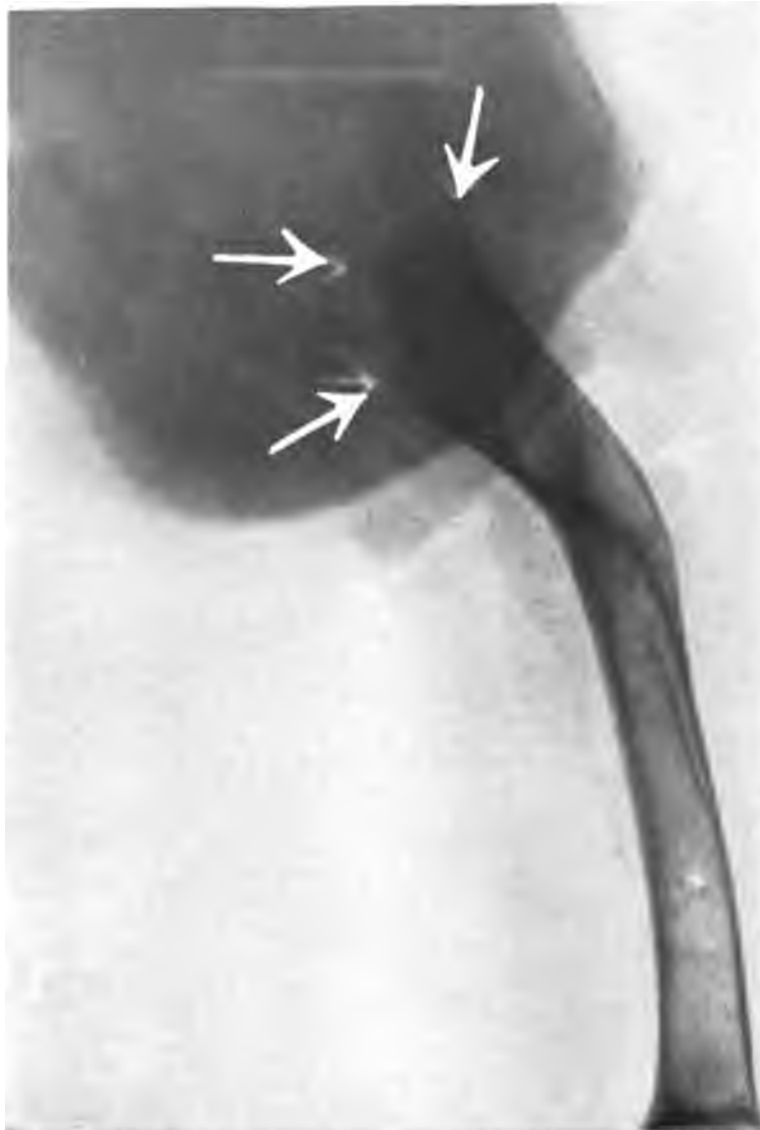


FIG. 73.—*Case 3.* Fourteen months after fracture the curvature was found much as seen six months before. The oblique line of union, in contrast to the original transverse line of fracture, could be traced across the shaft of the bone.



FIG. 74.—*Case 3.* At the twentieth month there was noted a slight decrease in the degree of curvature. The child was walking perfectly, there was no disability of any sort, while the measurements of the legs were equal.



FIG. 75.—*Case 3.* Three years had elapsed since the injury. A well-marked anterior curvature still persisted, similar to that found in *Cases 1* and *2*, situated at the juncture of the upper with the middle third of the bone. (Picture transposed by screen.)



FIG. 76.—*Case 3.* View made with the thigh flexed at a right angle with the body and abducted to show more clearly the type and degree of deformity characteristic of cases of birth fracture of the femur where measures to correct the all-important flexion of the proximal fragment have failed or been omitted in early treatment.

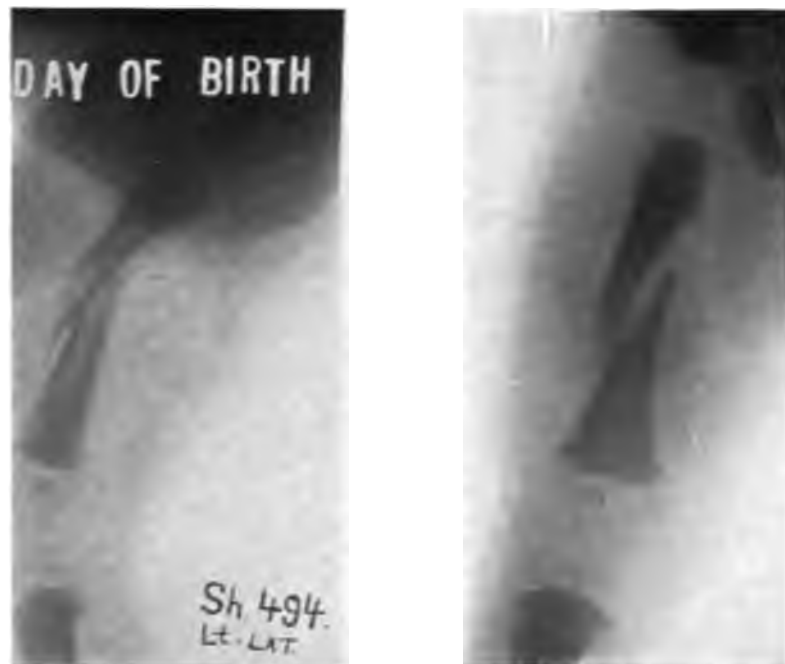


FIG. 77.—Case 4. Fresh fracture of the femur roentgenographed on the day of birth. The oblique line of fracture crossed the femur at the center of the shaft of the bone. The front view showed separation of the fragments, the lateral an anterior angulation.

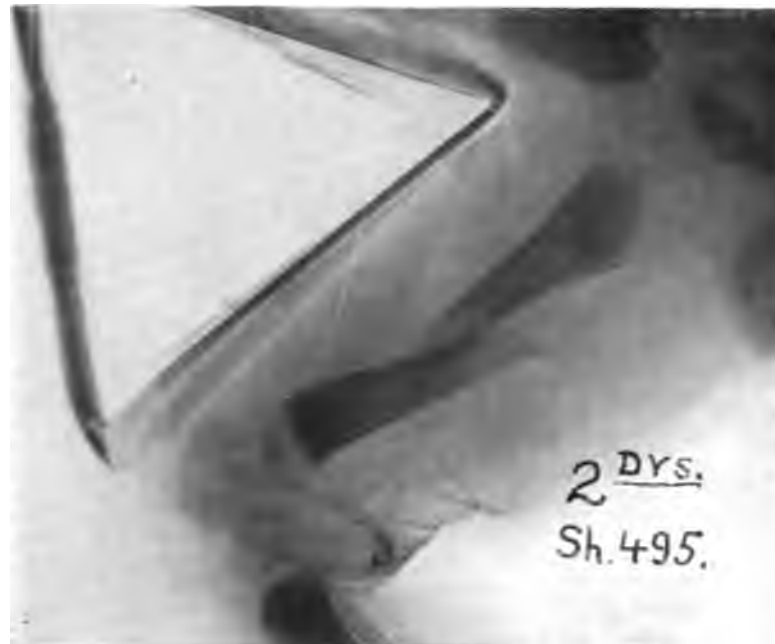


FIG. 78.—Case 4. The injured thigh has been placed upon the Van Arsdale splint. The triangular splint with its apex in the groin can be seen in the picture, also the outline of the wings of the part embracing the thigh, while about the lower third of the latter is seen a depression produced by the encircling band of adhesive plaster. The original displacement has been over-corrected.



FIG. 79.—*Case 4.* After five days' treatment on the Van Arsdale splint the condition of the fracture was found to be unsatisfactory. There was extreme over-riding of the fragments with shortening of the thigh, easily appreciated when the length of the thigh in this and the preceding picture is compared with the opposed side of the splint. The lower fragment has also dropped downward, forming a moderate angular deformity.

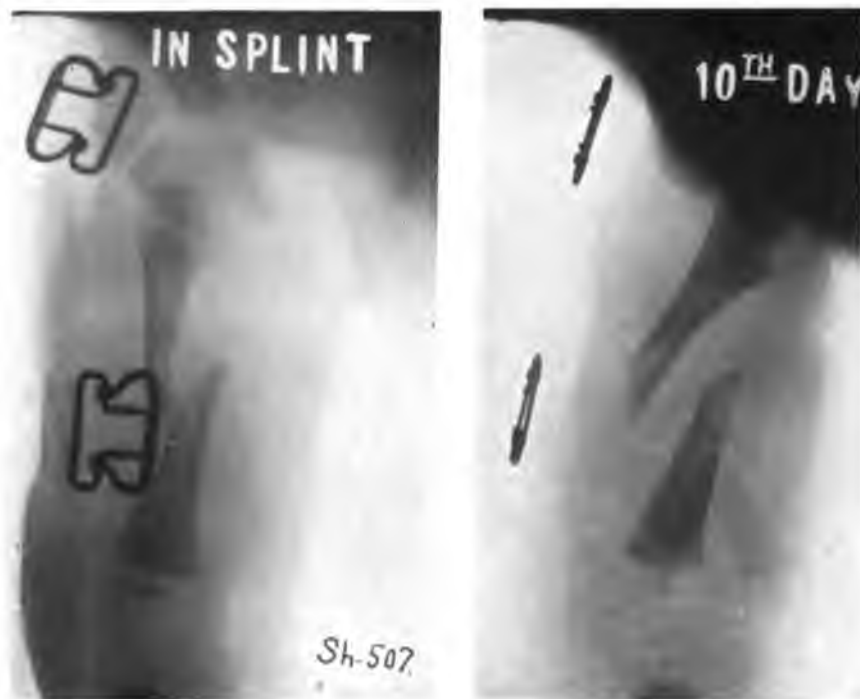


FIG. 80.—Case 4. In the hope of improving the deformity the leg was removed from the Van Arsdale splint and a long side splint applied. While the position as seen from the front was fairly satisfactory (at the left) the lateral view showed an aggravation of the angular deformity. Traction afforded by the side splint had reduced the over-riding but the flexion of the proximal fragment was even more acute than before, increasing the separation between the fragments.



FIG. 81.—*Case 4.* The Van Arsdale splint had been re-applied. The long axes of the fragments were parallel, though the portions of the bone were widely separated. There was still some over-riding. The fracture was surrounded by a large and firm callous mass. The position, for one of these cases, was fairly satisfactory, the anterior angular deformity having been eliminated.



Sh. 556. Lt.

FIG. 82.—*Case 4.* View made two weeks later, shortly before the death of the infant. Union was then firm and all dressings had been removed. The position of the fragments was not quite as favorable as at the time of the last observation, a moderate anterior angular deformity having developed. (See Fig. 114, 3. Fig. 115, 3.)



FIG. 83.—Case 5. Birth fracture of the femur treated in the Wyeth dressing. The thigh was flexed upon the abdomen, the leg extended as in frank breech presentation and the extremity fixed in this position by a light plaster-of-Paris dressing. The roentgenogram on the second day was not satisfactory, there being over-riding of the fragments with a lateral displacement. The upper extremity of the tibia can be seen in the upper left-hand corner of the picture.



Ava. 749.
LAT. 2 DAYS

FIG. 84.—Case 5. The lateral view of the same case in the same dressing revealed an excessive posterior angulation of the fragments of the femur, more aggravated than that commonly observed in an anterior direction. It will probably be found that this method of treatment fails to meet the requirements in these fractures if the roentgenograms of this case are representative.



FIG. 85.—*Case 5.* The Wyeth dressing has been removed and the fracture treated by means of the fracture box, tried for the first time. At the fifth week the union was firm, with the fragments parallel, though separated, and with some over-riding. It is believed that in cases such as this the final outcome will be good, the anterior angulation having been prevented, even if separation and over-riding have persisted. (See Fig. 114, 1. Fig. 115, 1.)

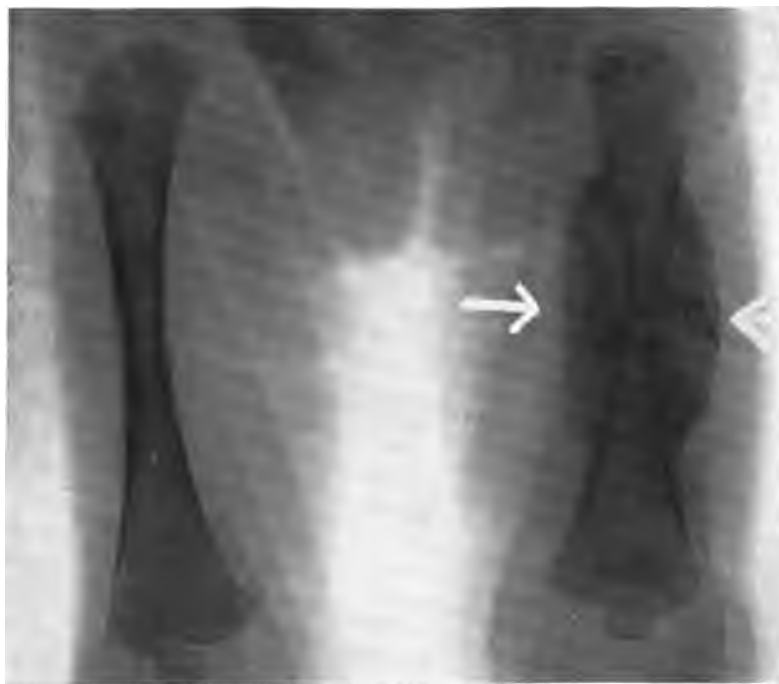


FIG. 86.—*Case 5.* The anterior view at this time was favorable. The callous mass was large and firm. Unfortunately observations of this case were terminated by the death of the infant soon after its departure from the hospital.



FIG. 87.—*Case 6.* Birth fracture of the femur successfully treated on the Van Arsdale splint. Two weeks after injury the fragments were found to be in good apposition and alignment. The line of fracture was oblique in this case, one of the three produced during Cæsarean section. The callous mass surrounding the break in the bone was large.



FIG. 88.—*Case 6.* At the end of three months the bone was found to be the most satisfactory of any in this series of cases. The line of fracture could still be made out, deep within the mass of surrounding new-formed bone.



FIG. 89.—*Case 6.* At the end of the eighth month the anteroposterior view showed some thickening of the center of the shaft of the fractured femur but otherwise no deformity. The lengths of the femora could be compared.



FIG. 90.—Case 6. The lateral view at this time presented a straight femoral shaft, the excess bone had been absorbed about the point of fracture. This case shows that good results can be obtained with the Van Arsdale splint if the over-riding of the fragments is not excessive and anterior angular deformity can be prevented. Whether the splint is suitable in a given case will depend upon the roentgen examinations.



FIG. 91.—*Case 7.* Birth fracture of the femur treated on the Van Arsdale splint, roentgenogram on the fifth day. Considerable over-riding had taken place, with decided anterior angulation of the fragments. The position was unsatisfactory.



FIG. 92.—*Case 7.* Repeated efforts to improve the condition of the fracture had failed to effect a change in the position of the fragments. It will be noted that the lower fragment lies parallel with the surface of the splint, while the pull of the muscles attached to the uncontrolled upper fragment has maintained the deformity.



FIG. 93.—*Case 7.* At the end of the third week union had taken place with considerable deformity persisting, the result of failure to control the upper fragment by this method of treatment in this particular case.

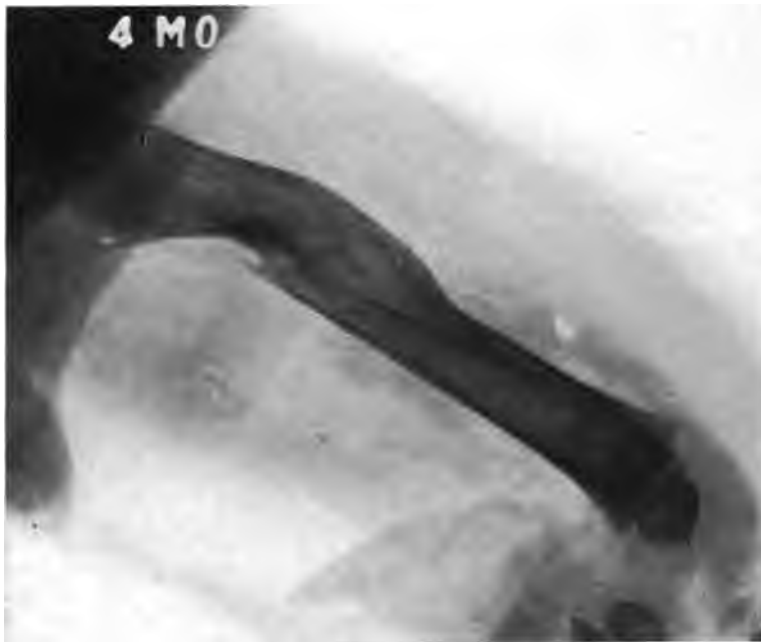


FIG. 94.—*Case 7.* The picture at the fourth month presented even greater deformity than had been expected. The anterior angular deformity was becoming an anterior curvature.



FIG. 95.—Case 7. The anteroposterior view at this time showed the result of moderate lateral displacement, causing thickening of the shaft of the bone at the point of fracture. There was no shortening of the femur and the result was good, so far as deformity in a transverse plane is concerned. The line of fracture was still visible within the new-formed bone.



FIG. 96.—*Case 7.* The lateral view at the tenth month resembled one of the late results in the untreated cases. Marked anterior curvature was present. The oblique line of union was noticeable, passing across the shaft of the bone, in contrast to the original line of fracture which was transverse.



FIG. 97.—*Case 8.* Birth fracture of the femur treated from the day of delivery in the box-splint with vertical upright. The roentgenogram on the fifth day showed the fragments parallel, though separated and slightly over-riding. This case was treated on the Outdoor Division, the infant brought to the hospital in the splint at intervals for adjustment of the dressing and roentgen examination.



FIG. 98.—*Case 8.* The view at the end of the second week showed no change in the position of the fragments. Callus has already appeared.



FIG. 99.—*Case 8.* At the end of the third week the fragments were found firmly united, much in the position noted in the first roentgenogram. Treatment was handicapped by infrequent opportunity to adjust the dressing as needed and maintain the necessary degree of traction.



FIG. 100.—*Case 8.* At six weeks the separated fragments, while parallel, were bridged by compact bone. Union was firm, and the splint had been removed.



FIG. 101.—*Case 8.* One month later an increase in the length of the bone was noted, the relative displacement of the fragments lessened. The medullary canals of the fragments had effected a communication through the interposed callus.



FIG. 102.—*Case 8.* Ten months after fracture there was marked increase in the length of the bone, while a moderate degree of anterior curvature had resulted. Evidence of the backward displacement of the lower fragment had disappeared. The outcome could be considered fair but not so good as might have been obtained had the opportunity for more careful treatment been afforded.

M. 2 WKS.



FIG. 103.—*Case 9.* Birth fracture of the femur treated in the box-splint with vertical upright. At the end of the second week there was over-riding, with considerable separation of the fragments. The callous mass had begun to enclose the point of fracture, while the periosteal bridge could be outlined sloping from the lower end of the upper fragment toward the lower end of the lower fragment.

M. 2 MOS.



FIG. 104.—*Case 9.* At two months the fragments were parallel, though separated. Union was accomplished by a large deposit of interposed compact bone. The new bone formed beneath the periosteal bridge upon the anterior surface of the lower fragment extended to the lower epiphyseal line.



FIG. 105.—*Case 9.* Five months after fracture the bone gave promise of a satisfactory final outcome, free from the anterior curvature it was so desired to avoid



FIG. 106.—*Case 9.* At eleven and one-half months the femur presented a slight double curvature, rather more deformity than had been expected but exaggerated by the notch or depression behind the femoral neck. A line drawn between the centers of the extremities will pass through the shaft, while the femur in this case has already begun to show the slight general anterior curvature often normally presented.



FIG. 107.—Case 10. Birth fracture of the femur on day of delivery, placed in the box-splint with inclined upright. Posterior angular deformity was present, and corrected by suitable adjustment of the leg along the upright part of the splint.



FIG. 108.—Case 10. View at the end of the fourth week when the splint was removed. There was practically no over-riding, little separation of the fragments, with a slight posterior angular deformity, preferable to that in the opposite direction.



FIG. 109.—Case 10. At six weeks the fragments were found in good alignment, without angulation or separation. Union was firm, with a compact callous mass surrounding the point of fracture, while the prospect of obtaining a straight femur was good. The anteroposterior view at this time showed no deformity.



FIG. 110.—Case 11. Birth fracture of the femur treated from the day of birth in the box splint. The upper fragment was sharply flexed, producing wide separation of the fragments. Over-riding was marked, while the lower end of the upper fragment can be seen immediately beneath the skin, where it could be plainly felt. The thigh is seen closely applied to the surface of the upright portion of the splint.



FIG. 111.—Case 11. Four days' treatment in the box splint having failed to reduce either the over-riding or the separation of the fragments and several attempts to correct the deformity by manipulation having been without effect, the lower fragment was brought into more satisfactory relationship with the upper by means of the modified Van Arsdale splint. In this case there was undoubtedly extensive laceration of the periosteum, the end of the upper fragment had been forced through the muscles on the front of the thigh. Complete reduction could have been accomplished only by an open operation, hardly justifiable for the prevention of deformity in these cases. The outline of the splint is shown.



FIG. 112.—*Case 12.* Untreated birth fracture of the femur, roentgenographed for the first time on the eighth day. There was great swelling of the thigh, evident in the picture, while displacement of the fragments was excessive. The Van Arsdale splint modified to form an acute angle would be preferable in a fracture of this type, with short and acutely flexed upper fragment, to the usual right angled variety. The box splint will usually control a flexed upper fragment when this is sufficiently long to be surrounded by a webbing strap and buckle.



FIG. 113.—Case of birth fracture of the femur incidental to frank breech delivery nineteen days after injury. For the first ten days the fracture had been treated by means of a plaster-of-Paris bandage with the thigh in extension. Union was firm when the first roentgen examination was made nine days later; there was acute flexion of the short upper fragment, the end of which could be felt beneath the skin. Over-riding was extreme, the upper end of the lower fragment approaching the upper end of the upper. There was also excessive anterior angular deformity, while the large and dense mass of interposed callus precluded the possibility of rectifying the condition of the fracture without open operation.

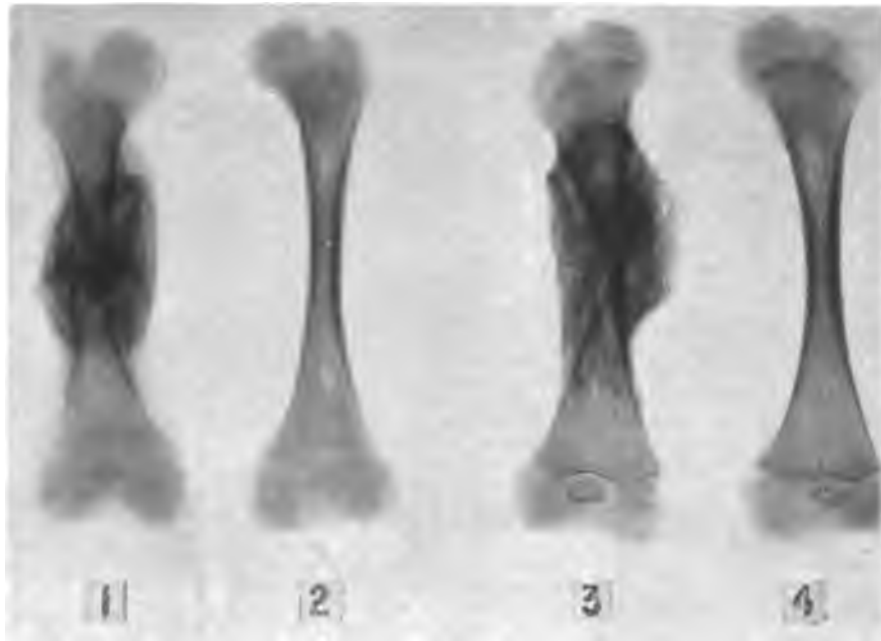


FIG. 114.—Femora removed by dissection from two cases of birth fracture of the femur. One and two are from *Case 5*, which died five weeks after injury; three and four from *Case 4*, six weeks after injury. There is moderate shortening of the shaft of the injured bone from *Case 5*, due to over-riding, not evident at first glance, as the epiphyses seem to compensate in the picture for the bony disparity. There is some rotation of the fragments of the broken bone from *Case 4*.

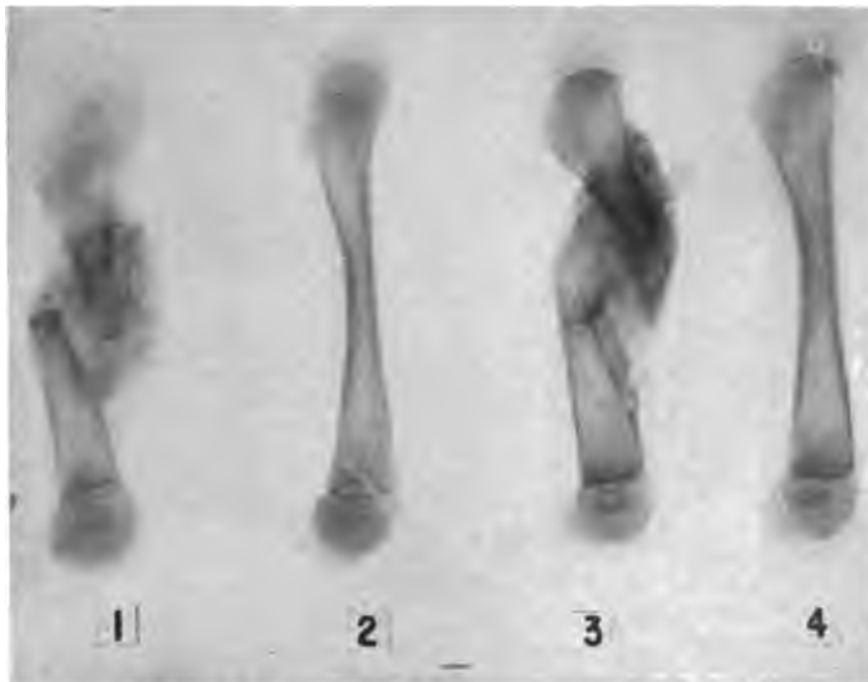


FIG. 115.—A lateral view of these bones. Both fractures would be considered in bad position in an adult. That of *Case 5*, however, should have resulted eventually in a bone without deformity, even in the presence of separation and over-riding, since angular displacement of the fragments has been avoided. For this reason the condition of the broken bone from *Case 4* is not so satisfactory.

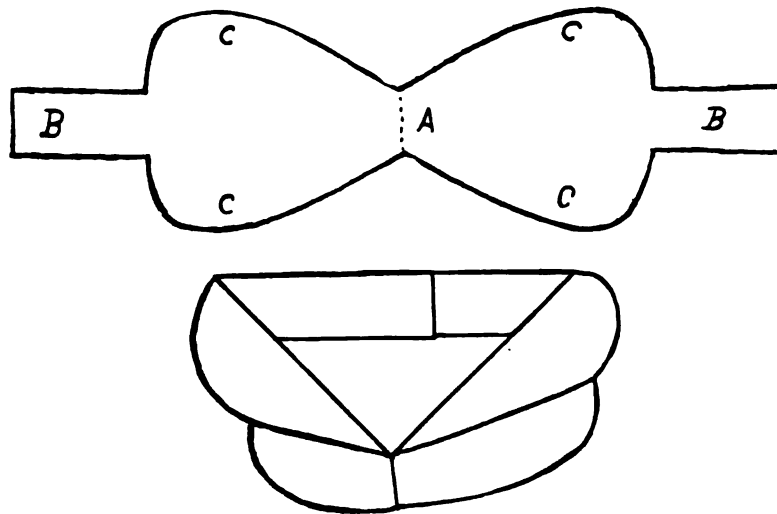


FIG. 116.—The Van Arsdale splint. Cut from thin sheet metal, preferably aluminum, as outlined in the upper figure, bent at a right angle at *A*, and secured in this position by bringing the prolongations, *B*, together. The wings *C* are then bent over to form the sides of the splint applied to the injured thigh and the side of the infant's body. The splint is covered with canton flannel and applied with roller bandages reinforced with strips of adhesive plaster. Owing to the extreme flexion of the upper fragment usually met with in cases of birth fracture of the femur, the splint will be found more satisfactory if the angle formed by bending the splint at *A* is rather less than a right angle. This will increase the flexion of the thigh, and secure a better alignment of the fragments. When the site of fracture is in the upper third of the femoral shaft, acute flexion of the upper fragment is usual. In these cases the Van Arsdale splint is probably the best method of treatment, particularly when modified by bending to an acute angle. It will not meet indications in this variety of fracture if used in the right-angled form.



FIG. 117.—The box-splint devised for treatment of birth fracture of the femur. The splint is built upon a base-board sixteen inches long, five and a half inches wide and one inch thick. The side-boards are five and one-half inches high, and cut away for five inches to a height of three inches at the lower end of the box to allow for the band passing over the infant's abdomen to afford counter-traction. The upright part of the splint is sixteen inches long, by two inches wide and one-half inch thick. The upright has an inclination of ten to fifteen degrees, to bring the flexion of the injured thigh slightly beyond a right angle with the body. It is also inclined sideways to a corresponding degree, to afford abduction of the leg. The inner side of the upright arises from the center of the base-board, while the outer side is shaped below to meet the end of the corresponding side-board, thus to strengthen its position. One large or two smaller pulleys are fixed to the upper end of the upright to carry the traction cord, while a screw-hook at the base is used to fasten the large elastic band by which the traction is made.



FIG. 118.—End view of the box-splint, to show the construction of the upright. The under-surface of the footpiece is also shown, with its broad base, which rests upon the upright when in use, and so prevents rotation of the leg. The adhesive plaster traction strips are also shown, greatly fore-shortened.



FIG. 119.—Case of birth-fracture of the femur under treatment in the box. The broad band of adhesive plaster is seen passing across the infant's abdomen and about the box. The webbing straps with buckles pass across the fractured thigh and about the upright. Traction is being exerted by means of the footpiece, the traction tape and the elastic band secured at the base of the upright.

DISLOCATIONS OF THE
CARTILAGINOUS EPIPHYSES



DISLOCATIONS OF THE CARTILAGINOUS EPIPHYSES

The infant frequently suffers considerable violence during its birth, and this is mainly from two sources. The uterine contractions are often of such intensity of themselves as to be the cause of serious injury to the child, while the difficulty in effecting delivery in many operative procedures may result in unfortunate consequences to structures as tender as are those of the infant at term. Obvious birth injury to the infant is not uncommon, while many lesser injuries may pass unnoticed unless carefully looked for. Fractures of the bones of the extremities are more or less obvious clinically, while dislocations of the epiphyses, familiar in later years, are more often suspected than proven to exist in the new-born. The opportunity for operative confirmation of these injuries is rare, while autopsies performed upon infants still-born do not customarily include an examination of the extremities. Nor does the roentgen examination offer such direct assistance in the diagnosis of these conditions as might be hoped for, since those of the cartilaginous epiphyses lacking a nucleus of bone within their substance at birth do not reveal their whereabouts with precision in the roentgenogram. This bone nucleus is quite regularly present in the lower femoral epiphysis of the infant at term, and is frequently present in the upper humeral epiphysis at the same period of development. Its presence in the lower femoral epiphysis renders easy the diagnosis of dislocation of that member at the time of its occurrence.

One case only of birth dislocation of the lower femoral epiphysis has been discovered. The infant had been delivered by version and breech extraction, considerable difficulty having been experienced at the time in effecting the delivery of the after-coming head, which had necessitated excessive manipulation of the legs. There was no suspicion of injury to either leg at the time, although a day or two later one thigh was found to be red, tender and greatly swollen.

Believing that no injury had been done the leg during delivery, the condition of the thigh was treated at first as a deep infection and no roentgenogram was made until the tenth day. The correct diagnosis was then readily

112 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

made, the lower femoral epiphysis being found displaced not only backward and outward but also considerably upward behind the shaft of the femur. Callus had already been deposited beneath the stripped-up periosteum, and efforts at replacement of the epiphysis by manipulation failed. The case was kept under observation and frequent roentgenograms made, the investigation unfortunately terminating with the death of the child from bronchopneumonia at the end of the seventh month, but not before nature's procedure in restoring the injured femur to normal had been definitely indicated and largely carried out. New bone was deposited beneath the stripped-up periosteum and a new and composite lower femoral shaft modeled. This was formed partly of new bone and partly of the original femoral shaft, and terminated below at the displaced epiphysis, with its nucleus of bone situated accurately between the two new condyles.

Diagnosis of backward dislocation of the lower humeral epiphysis cannot be made from the roentgenogram earlier than the end of the first week of life. The ossification centers contained in the lower humeral epiphysis do not produce new bone and thus furnish a guide before the latter half of the first year. For this reason pictures showing a backward displacement of the bones of the forearm at the elbow will make no distinction between a backward dislocation of the elbow and a backward dislocation of the lower humeral epiphysis. Presumptive evidence of dislocation of this epiphysis is of three kinds: certain obstetrical procedures are such as might readily produce this lesion; force similarly applied to the region of the elbow has produced this injury experimentally in the full-term, still-born child; roentgenograms will present direct evidence of the existence of this dislocation by the tenth day if it be appreciated that periosteum stripped up from the shaft of a bone in the new-born deposits new bone along its under surface. Furthermore roentgenograms made at intervals during the first six months will reveal the construction of a new and composite lower humeral shaft, such as was seen in the case of known dislocation of the lower femoral epiphysis, which is evidently being developed towards an abnormally situated but invisible cartilaginous epiphysis, with a view to restoring this to its normal position at the lower extremity of the new-formed bone.

Four cases of posterior dislocation of the lower humeral epiphysis have been observed. In all of these delivery had been accomplished by version and breech extraction and difficulty met with in bringing down arms that were extended above the head. In two cases some structure had been felt to

snap, thought at the time to be the shaft of the humerus, and roentgenograms were made immediately after delivery to confirm this impression.

Case 1 was brought to the hospital from the Out-door Department when two weeks old. There was disability of the arm, and about the lower humeral shaft was felt a large and hard callous mass. A diagnosis was made of supracondylar fracture of the humerus. The roentgenogram disclosed an absence of fracture, but showed the mass felt about the lower humerus to consist of deposits of new-formed bone. The nature of the injury was not appreciated at the time and efforts made later to find the child for further observations were unavailing, although it was learned from apparently well-informed neighbors that the use of the arm had been completely recovered. In *Case 2* the only roentgenograms made were those obtained on the eighth day. This case too had been thought to have a fracture of the shaft of the humerus. Two views were made, the anteroposterior presenting a picture quite similar to that obtained in *Case 1*; the lateral, here introduced for the first time, and since regularly employed, showing a deposit of new bone extending along the posterior surface of the shaft of the humerus, thickest at the lower extremity, tapering upwards, and suggesting for the first time the roentgen appearance of backward dislocation of the lower humeral epiphysis.

Case 3 has been under observation since the day of birth, and frequent observations have been made over a period of two years. Unusual difficulty had been experienced in the bringing down of the extended arms and when some structure was felt to snap it was thought that the humerus had been fractured. The arm dangled at the side after delivery and crepitus was obtained on examination, although there was no false point of motion over the center of the shaft of the humerus. The roentgenogram, however, quickly ruled out fracture and it was then suspected that a dislocation of the lower epiphysis of the humerus had been sustained. The anteroposterior view made on the fourteenth day corresponded closely with the findings in *Cases 1* and *2*, while the lateral view showed the deposit of new bone along the posterior surface of the shaft of the humerus as in the lateral view of the second case. Successive observations showed the progress of this new-bone formation along the posterior surface of the shaft of the humerus, and after the second month the beveling off of the lower part of the shaft of this bone below and in front became more and more evident. As time went on the deposit of new bone posteriorly became an integral part of the shaft of the humerus and could not be distinguished

114 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

from the original. The beveled area anteriorly was observed as long as twenty-two months after injury, and just beneath the tip of this the nucleus of bone at the ossification center for the capitellum made its appearance at the same time and in exactly the same position as upon the uninjured side. With the exception of slight limitation of the function of flexion at the elbow the injured arm was normal in every way.

The dislocation of the lower humeral epiphysis in *Case 4* was produced under conditions identical with those in *Case 3*. The dislocation occurred with a distinct snap, readily perceptible. The arm dangled at the side, crepitus was obtained and the roentgenograms were negative until the twelfth day, when the beginning deposit of new bone posteriorly was barely traceable. At four weeks, the deposit was definite, while the anteroposterior view disclosed the fact that in this case the dislocation was more inward than backward, the lesion being more evident from this aspect. This case is too recent to permit the completion of the observations.

Since some degree of limitation of flexion of the fore-arm may follow a backward dislocation of the lower humeral epiphysis, particularly if the displacement is excessive, the question of treatment is of some importance. This, in turn, will depend upon the possibility of making the diagnosis of the existence of the dislocation. By the time the lesion can be shown in the roentgenogram, replacement of the dislocated epiphysis may have become impossible. When an infant delivered by version and breech extraction, particularly if the arms have been extended above the head and difficulty has been experienced in bringing them down, is born with an arm dangling at the side the possibility of dislocation of an epiphysis should be kept in mind. Examination of the injured arm should make it possible to exclude fracture of the shaft of the humerus by the absence of false-point of motion. This done, the presence of crepitus, with possibly abnormal motion at the elbow in a backward and forward direction when the fore-arm is held at right angles to the arm, should be sufficient to indicate the treatment of the condition as one of dislocation of the lower epiphysis. The fore-arm should be extended, traction exerted downward and then, while the traction is maintained, the fore-arm flexed acutely on the arm and secured in this position with a Velpeau bandage until time has been given for union of the epiphysis to the shaft to take place. Replacement may be aided by pressure directly over the lower epiphysis from behind forward during this maneuver. The existence of this dislocation in a case of dangling arm at the time of delivery, without fracture

of the center of the shaft of the humerus, where crepitus is present, and particularly if some structure has been felt to snap during the delivery of the arm, is always a high probability. Were these facts kept more prominently in mind more dislocations of this type might be detected. By the twelfth day roentgen confirmation of the injury should be obtainable.

While these cases were under observation experimental dislocations were attempted in full-term, still-born infants. The arm was grasped firmly in one hand, the fore-arm in the other, and forcible hyperextension suddenly applied to the region of the elbow until some structure was felt to give way. Upon dissection of these arms it was found that a rupture of the anterior ligaments at the elbow had occurred or that a dislocation backward of the lower humeral epiphysis had been produced. Where the dislocation had occurred the periosteum of the shaft of the humerus had been ruptured at the epiphyseal line anteriorly, the cartilaginous epiphysis displaced backward but still attached to the shaft of the bone by a bridge of stripped-up periosteum. The lesion was such as would explain the shadows seen in the roentgenograms, and produce the two characteristic varieties of callus formation noted in deposits formed about fractures of the humerus and femur. The lacerated periosteum in the region of the epiphyseal line anteriorly would be expected to develop an irregular mass of rather dense callus, while the callus formed beneath the stripped-up periosteal bridge posteriorly would present the second type of deposit, that seen applied along the shafts of bone fragments, less dense, and cleanly limited by the enclosing periosteum.

The evidence supporting belief in the existence of birth dislocation of the upper humeral epiphysis has been scant but convincing. The shoulder joints of two infants delivered still-born at term by version and breech extraction with arms extended were cut down upon and a dislocation of each upper humeral epiphysis discovered. There was extravasation of blood both within and about the shoulder joints, with lacerations of the capsular ligaments. The lesion had evidently occurred before death. In another case, delivered living under similar conditions, the arm dangled at the side, a marked swelling developed about the shoulder and the roentgenograms began to show the results of the lesion by the deposit of new bone about the upper humeral shaft. At this time the infant was unfortunately taken away by its mother and could never be found thereafter.

The roentgen diagnosis of birth dislocation of the upper humeral epiphysis was definitely made in a case delivered by version and breech extraction with

116 BIRTH FRACTURES AND EPIPHYSEAL DISLOCATIONS

arms extended in which a fracture of the humerus was suffered on one side and the upper epiphysis dislocated on the other. Disability of the arm supposedly uninjured was noted during the first few days and as this had begun to wear away the roentgenograms began to indicate the nature of the lesion. Subperiosteal shadows were noted about the upper extremity of the shaft of the humerus, broadest at the epiphyseal line, and tapering downwards. The head of the bone, as indicated by its ossification nucleus, had apparently retained its normal position, while the shaft had been forced away from it with stripping up of the periosteum for a short distance downwards. The displacement evidently had not been great. Several observations of this case were made at intervals and all presented the same picture in the roentgenogram. The recovery of the function of the arm was early and complete. At the end of the first month considerable thickening could still be felt about the upper part of the shaft of the humerus.

REFERENCE

- ¹ BONNAIRE ET ECALLE. *Archives mensuelles d'obst. et gym.* 1913, p. 49.



FIG. 120.—Femora removed from a full-term, still-born infant, an experimental dislocation of the lower femoral epiphysis having been produced on one side. The normal femur, at the left, shows the lower epiphysis, with its nucleus of bone, in its usual situation at the lower end of the shaft. At the right is shown a dislocation backward and upward of the lower epiphysis, which is still attached to the shaft by a periosteal bridge. The nucleus of bone at the ossification center should be noted as this forms the guide to the position of the cartilaginous epiphysis upon roentgen examination of the thigh in the new-born.



FIG. 121.—Case 1. Birth dislocation of the lower femoral epiphysis, produced by manipulation of the legs during breech extraction. In the normal bone, seen at the left, the nucleus of bone within the cartilaginous epiphysis was found in its usual position at the lower end of the shaft of the femur, while in the injured bone at the right, the epiphysis, as indicated by the bone nucleus, was found displaced backward and upward behind the lower extremity of the femoral shaft. The periosteum had been partially stripped from the shaft of the femur, and, still attached to the epiphysis, had begun to produce new bone, just visible in the picture.



FIG. 122.—Case 1. At the end of the second week the epiphysis was found to occupy the same abnormal position, while there had been an increase in the callus deposited, which is seen surrounding the lower third of the shaft of the femur.



FIG. 123.—*Case 1.* Three weeks after injury there was further increase in the deposit of new bone. The ossification nucleus was seen in the midst of a clear area, the cartilaginous epiphysis, situated at the lower limit of the callous deposit, upon the posterior surface of the lower femoral shaft. The area occupied by the invisible epiphysis can be readily imagined in this picture.

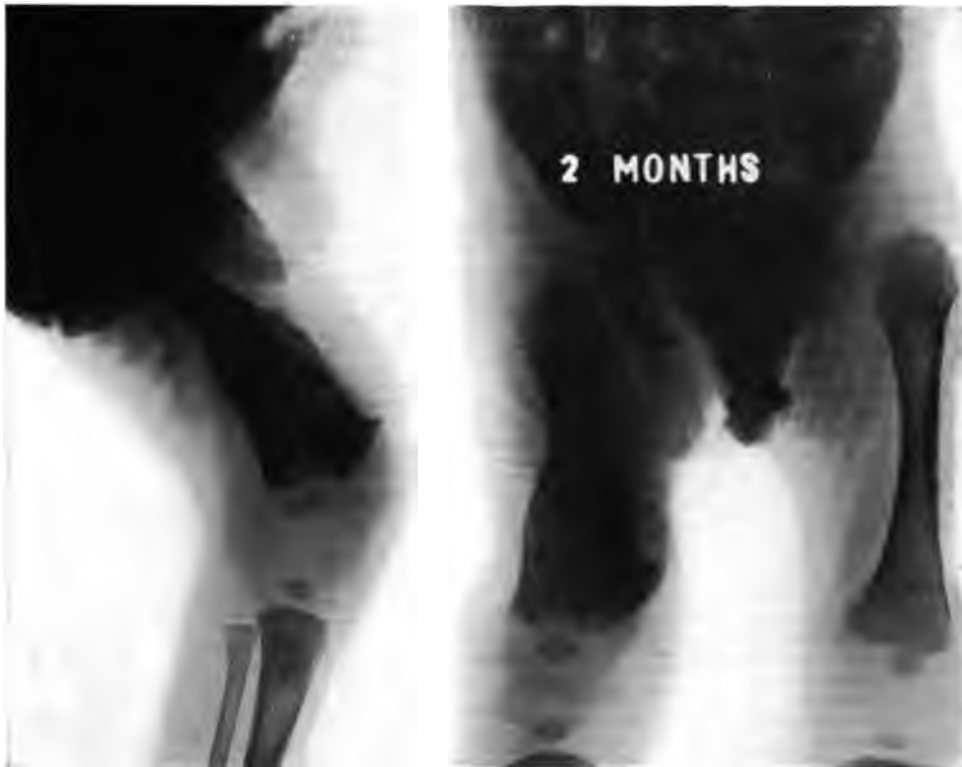


FIG. 124.—*Case 1.* At two months the formation of a new femoral shaft to meet the displaced lower epiphysis was well under way. New bone formation, increasing in amount from above downward, was seen for fully three-quarters of the length of the original shaft. Absorption of the superfluous portion of the original bone was in progress.



FIG. 125.—*Case 1.* At the fourth month the new-formed femur compared quite favorably with its fellow of the opposite side. The new and original portions of the femoral shaft differed but slightly in density. Indications of the new internal and external condyles were evident, the ossification nucleus occupying its usual position in the depression between them.



FIG. 126.—*Case 1.* Six months after the injury the roentgenogram showed a femur differing but slightly from the normal. The injured bone was relatively short and presented a moderate anterior curvature. However, the new and composite bone had increased in length, since the epiphysis is now below the lower termination of the original femoral shaft in place of above and behind it as when first observed, indicating that the bone-producing function of the displaced epiphysis was unimpaired. There was further absorption of the superfluous portion of the original shaft and increased density of the new. A new medullary canal was forming, while the ossification nucleus had increased in size. A more favorable outcome in a corresponding time could hardly have been looked for following an operative replacement of the dislocated epiphysis.



FIG. 127.



FIG. 128.



FIG. 129.

FIGS. 127-129.—Diagram representing the pathology of backward dislocation of the lower humeral epiphysis; a key to the roentgenograms representing this lesion.

FIG. 127 shows the lateral aspect of the left humerus in the new-born, with the relatively large cartilaginous epiphyses at either end of the bony humeral shaft. The upper epiphysis is shown containing a nucleus of bone, the ossification center. This is frequently present at birth, when it is regularly noted in the roentgenogram. The ossification centers in the lower epiphysis produce no bone before the second half of the first year. As a cartilaginous epiphysis in the normal state throws no shadow on the roentgen plate, roentgenograms of the new-born will make no distinction between a backward dislocation at the elbow and a dislocation backward of the lower humeral epiphysis.

FIG. 128 represents a fresh dislocation backward of the lower humeral epiphysis. The periosteum has been torn across at the epiphyseal line in front, the epiphysis has been displaced backward, carrying with it the intact periosteum stripped upward from the posterior surface of the humeral shaft.

FIG. 129 indicates Nature's procedure in the process of repair. A new and composite portion of humeral shaft is evolved, made up of new bone formed beneath the stripped-up periosteum behind and including a portion of the original shaft in front, the superfluous part of the latter being absorbed. As the new bone is deposited more rapidly than the old is absorbed, serial roentgenograms of this injury should show progressive formation of new bone along the posterior surface of the humeral shaft in the earlier pictures, while in the later there should be noted a beveling off of the lower part of the bone in front. In this way the displaced epiphysis will be reinstated in its normal position at the lower extremity of the shaft of the humerus.



FIG. 130.—Experimental dislocation of the lower humeral epiphysis in the new-born. The epiphysis is displaced backward, but is still attached to the shaft of the bone by a bridge of periosteum. The rupture of the periosteum at the epiphyseal line in front is shown.



FIG. 131.—Roentgenogram of the preceding specimen. The contrast in the roentgen shadow between the bone of the shaft and the cartilage of the epiphyses is well shown. The upper epiphysis contains a nucleus of bone at the ossification center. The lower epiphysis, displaced backward, is attached to the humeral shaft by the periosteal bridge. The cup-shaped depression in the upper surface of the lower epiphysis which normally contains the lower end of the shaft will be referred to later.



FIG. 132.—*Case 1.* Roentgenogram of arm of infant two weeks old. A mass of callus had been felt about the lower part of the humerus and a supracondylar fracture was suspected. The roentgenogram showed the absence of a fracture, while small deposits of new-formed bone of uncertain origin were discovered about the lower extremity of the humerus. The nature of the injury in this case was left in doubt by the roentgen examination, which had been expected to reveal a new variety of fracture. The site of fracture in all cases of birth fracture of the humerus observed has been at or near the center of the shaft of the bone, and roentgenograms of these fractures have commonly been made in the anteroposterior direction. As the story of backward dislocation of the lower humeral epiphysis is told in serial roentgenograms showing the lateral aspect of the arm, it is not surprising that the nature of the injury present was not appreciated in this case, the first coming under observation.



FIG. 133.—Case 2. Anteroposterior roentgenogram of arm of infant eight days old, thought to be a fracture of the humerus. No fracture was found, but deposits of new-formed bone were noted about the lower extremity of the shaft of the humerus. The lesions as observed in the roentgenogram in this and the preceding case were so similar as to establish the identity of the injuries.



FIG. 134.—Case 2. Lateral view of the same arm. A beginning deposit of new bone was shown upon the posterior surface of the shaft of the humerus. This was a long, slender wedge, with base below, covering half the length of the bone, and occupying the space produced in experimental dislocation of the lower epiphysis between the periosteal bridge and the posterior surface of the humeral shaft.



FIG. 135.—*Case 3*. Roentgenogram of arm of infant one week old. During the delivery of the extended arms following version it was thought that the humerus had been fractured. Earlier pictures had ruled out fracture. As dislocation of the lower humeral epiphysis had been considered as a possible explanation of the roentgen findings in *Cases 1* and *2*, roentgenograms were made in this case at the end of the first week in expectation of the appearance of new-formed bone about the lower extremity of the humerus. Evidence of the existence of this lesion in the new-born was directly sought for in this case.



FIG. 136.—*Case 3*. Anteroposterior view of same arm at the fourth week. Deposits of new bone have appeared about the lower extremity of the humeral shaft. This picture is shown to connect *Cases 1* and *2* (Figs. 132 and 133) with *Case 3*, although at a stage two weeks later than Fig. 132, and three weeks later than Fig. 133.



FIG. 137.—*Case 3.* Lateral view of this arm at the end of the second week showed a subperiosteal deposit of new bone occupying the posterior surface of the humeral shaft for two-thirds of its length. A more localized deposit was seen over the lower part of the shaft in front, the ruptured epiphyseal attachment anteriorly. These deposits correspond with such periosteal injuries as have been found to go with backward dislocation of the lower humeral epiphysis in the new-born. Compare with Fig. 134, *Case 2.*

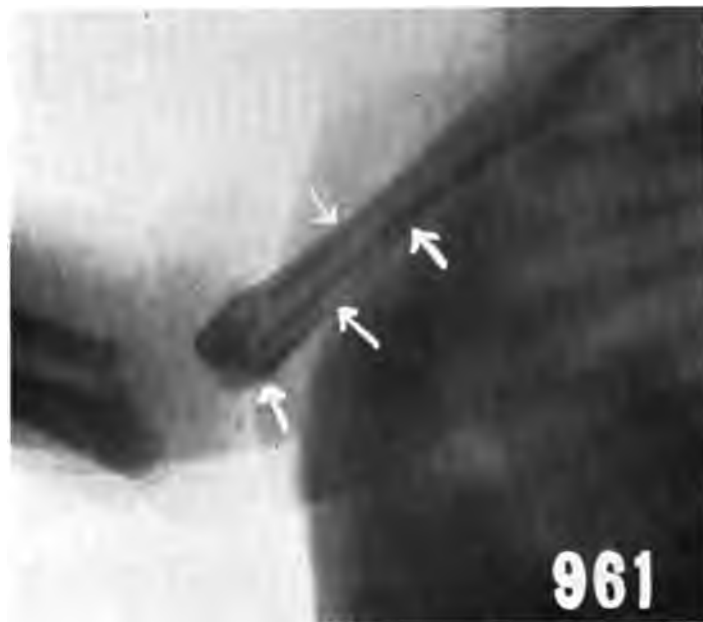


FIG. 138.—*Case 3.* Four weeks after injury the new bone behind the shaft of the humerus was more definitely outlined, being increased in quantity and density. A fairly large callous mass could be felt over the lower part of the humeral shaft, particularly in front. The arm was used as freely as that of the opposite side, although there was moderate limitation of flexion of the fore-arm upon the arm.

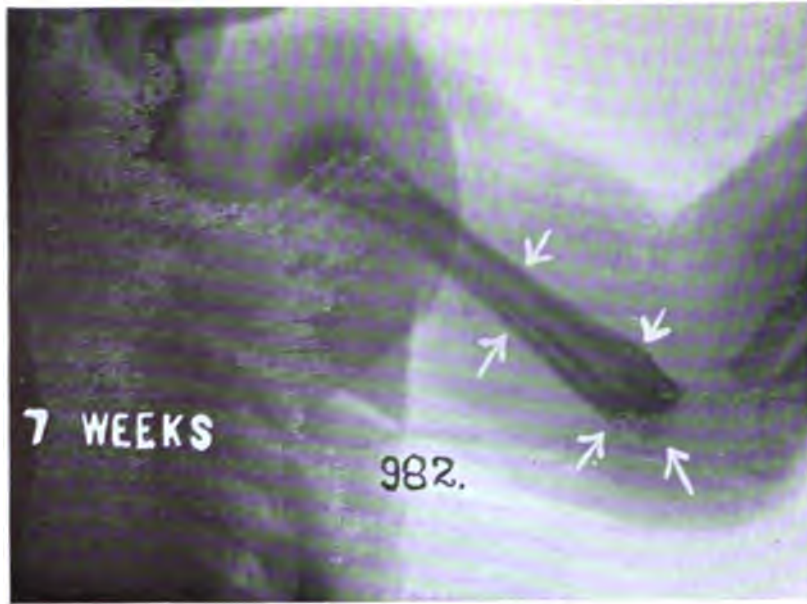


FIG. 139.—*Case 3.* At the end of the seventh week the new bone nearly equaled the old in density. The beveling off of the superfluous portion of the original shaft in front and below had begun, while the new and the old bone were seen to be rounding off at the extremity to occupy the cup-shaped depression in the upper surface of the cartilaginous epiphysis. (See Fig. 131.)

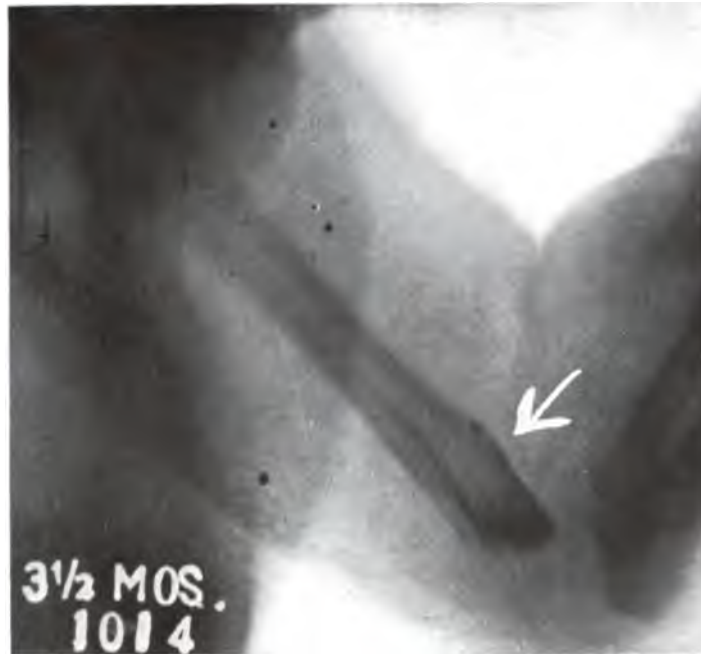


FIG. 140.—*Case 3.* Three and a half months after injury the new bone had almost blended with the original along the posterior humeral shaft. The extent and degree of beveling of the shaft in front and below was clearly shown, a change late in making its appearance, for the reason that the process of absorption of bone is less rapid than the production of new. The callous mass felt about the lower part of the arm, during the earlier weeks, resembling that found in a supracondylar fracture in childhood, had entirely disappeared.

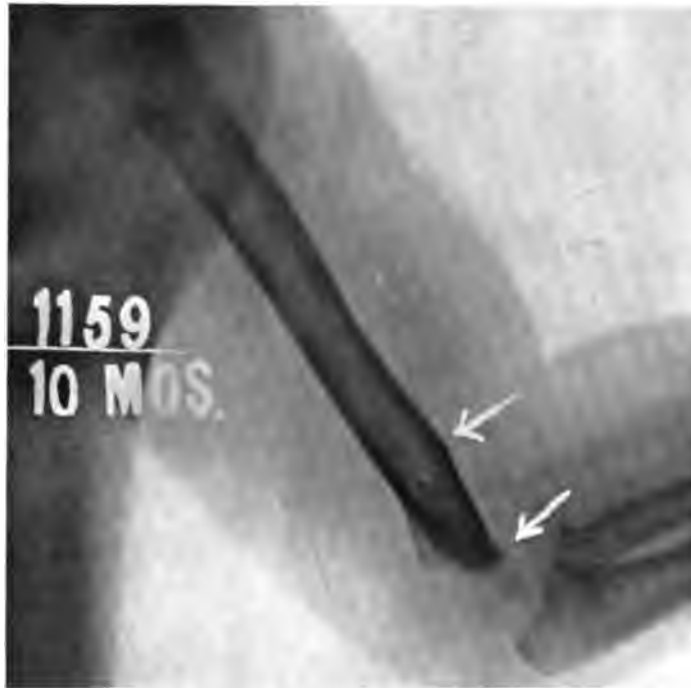


FIG. 141.—*Case 3.* At ten months the roentgenogram still revealed evidence of the birth dislocation of the lower epiphysis. The beveling off of the shaft of the humerus was more striking than ever, partly because of the increase in the length of the bone by growth at the lower epiphyseal line. New bone was seen developing at one of the ossification centers in the lower epiphysis. This fact, together with the increase in the length of the bone at its lower end, would indicate that posterior dislocation of the epiphysis at birth neither blights nor destroys the very important epiphyseal functions.



FIG. 142.—Deformity in a child of four, thirteen months after a supracondylar fracture of the humerus, with backward displacement of the lower fragment. The displacement had never been satisfactorily corrected, and the deformity corresponded, in a manner, with a dislocation backward of the lower humeral epiphysis. The picture is shown because of the similarity of the late deformity in cases of supracondylar fracture and of dislocation backward of the lower epiphysis when replacement of the displaced part has not been accomplished.



FIG. 143.—*Case 3.* Twenty-two months after injury the beveling of the lower humeral shaft was still quite evident, the residual deformity of the old dislocation. Slight but definite limitation of flexion at the elbow still persisted.



FIG. 144.—*Case 3.* Lateral view of the uninjured humerus shown for comparison. The nucleus of bone in the lower epiphysis developed at the ossification center for the capitellum has made its appearance and corresponded in size and position with that in the dislocated epiphysis shown in the preceding picture.



FIG. 145.—*Case 4.* Birth dislocation of the lower humeral epiphysis. The child had been delivered by difficult breech extraction with arms extended above the head. During the attempt to bring down the right arm something was felt to snap, and it was thought that the humerus had been fractured. The roentgenogram made on the day of birth showed the absence of fracture.



FIG. 146.—*Case 4.* On the third day the arm hung by the side, there was swelling and slight discoloration above the elbow and crepitus was obtained. The diagnosis of separation of the lower epiphysis of the humerus was made, and the case treated as such. The lateral view made on the twelfth day did not show new-formed bone along the posterior surface of the shaft of the humerus as expected, its development being tardy in this instance.



FIG. 147.—*Case 4.* At the fourth week the roentgen picture characteristic of this injury was obtained. The infant was now moving its arm, and there was but slight disability, while a hard mass was felt about the lower third of the shaft of the humerus.



FIG. 148.—*Case 4.* The anteroposterior view showed the injury to better advantage than did the lateral in this case, the epiphysis having been displaced more inward than backward. There was an excess of callus thrown out in the region of the epiphyseal line, while the new-formed bone beneath the stripped-up periosteum was seen tapering upward along two-thirds the length of the humeral shaft. The roentgen evidence of this dislocation would never have been obtained had it not been looked for during the third week of life.

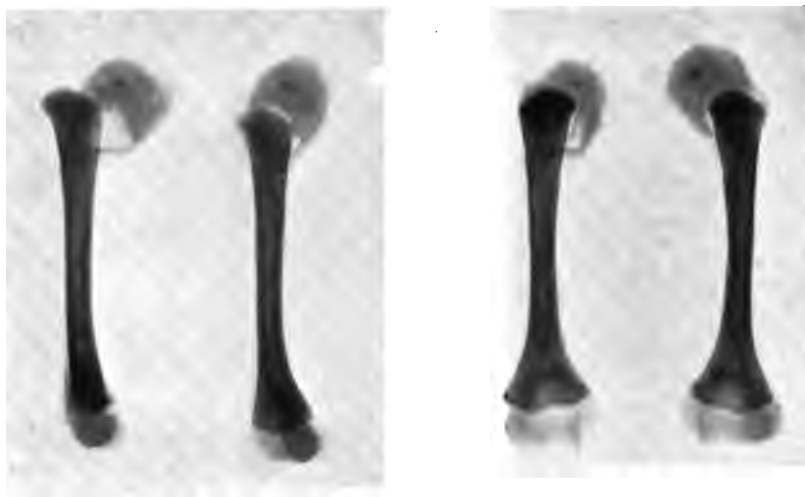


FIG. 149.—Humeri removed by dissection from still-born infant delivered with difficulty by version and breech extraction because of its size. The arms had become extended above the head. On cutting down upon the shoulder joints the capsular ligaments were found ruptured. There was considerable extravasated blood, both within and about the joints, and both upper humeral epiphyses were found to have been dislocated. While this birth injury is undoubtedly rare, there are conditions under which it might reasonably be expected to occur, as in difficult breech extraction with arms extended above the head. As the conditions under which this injury is most likely to be produced frequently result in the death of the infant, the opportunity to study this dislocation has been very limited. The autopsy in this case served to prove the existence of this birth dislocation and to stimulate effort to determine whether the upper humeral epiphysis had been dislocated in cases of evident birth injury to the arm unassociated with fracture.



FIG. 150.—Case 1. Birth dislocation of the superior humeral epiphysis. The arm hangs at the side, there is swelling about the shoulder, due to extravasation within and about the shoulder joint. The deformity is very similar to that observed in dislocations of the shoulder in adults. Photograph of infant delivered by difficult breech extraction with arms extended above the head.

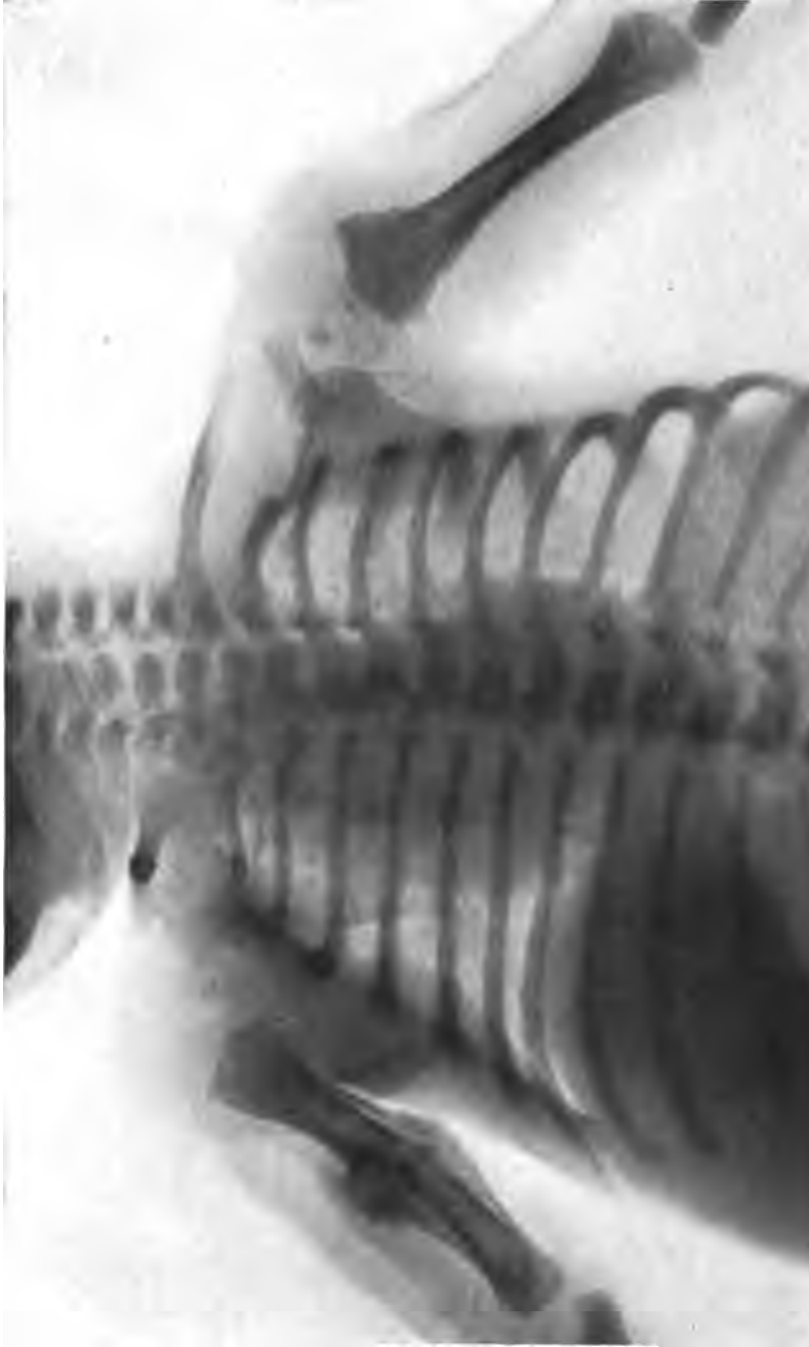


FIG. 151.—Case 2. Roentgenogram of a case of fracture of the left humerus, with dislocation of the right upper humeral epiphysis, injuries received during difficult breech extraction with arms extended above the head. At the fourth week the fracture had firmly united. There was a mass of callus in front of the point of fracture, probably representing a rent in the periosteum, while new-formed bone beneath the stripped-up periosteum, thickest at the point of fracture, shaded off towards the extremities of the humerus. The upper part of the right humeral shaft was seen surrounded by a cone-shaped deposit of similar bone. This was most marked in the region of the epiphyseal line, shading off towards the center of the bone and away from the point of injury. This is the picture produced by separation of the upper humeral epiphysis, obtained only after the process of new-bone formation is sufficiently advanced to throw a shadow in the roentgenogram. A dangling arm, with swelling about the shoulder, following a delivery which is liable to cause an epiphyseal separation aids in determining the early diagnosis, the roentgen evidence being of value only after these signs have mostly disappeared. The Wassermann reaction was negative in both mother and child.

PAUL B. HOEBER,
67-69 East 59th Street,
New York.

LANE MEDICAL LIBRARY

To avoid fine, this book should be returned on
or before the date last stamped below.

FEB 12 1922

NOV -7 1932

JUL 10 1940

P325 Truesdell, E.D. 45466
T86 Birth fractures and
1917 epiphyseal dislocations.
FEB 12 1922

ALCONA

Univ. Oregon

Robert A. Kuyper

APR 27 1937
DEC 20 1966

